# SCIENTIFIC AMERICAN

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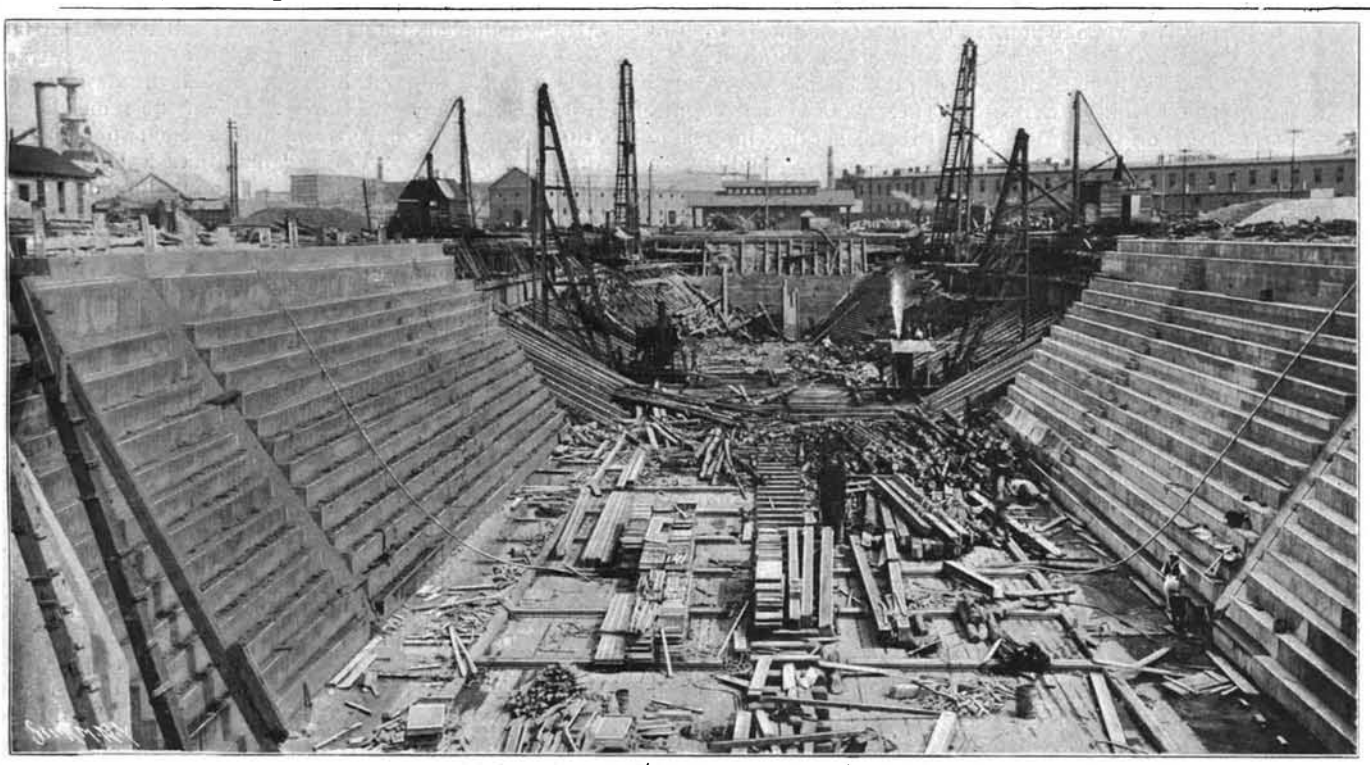
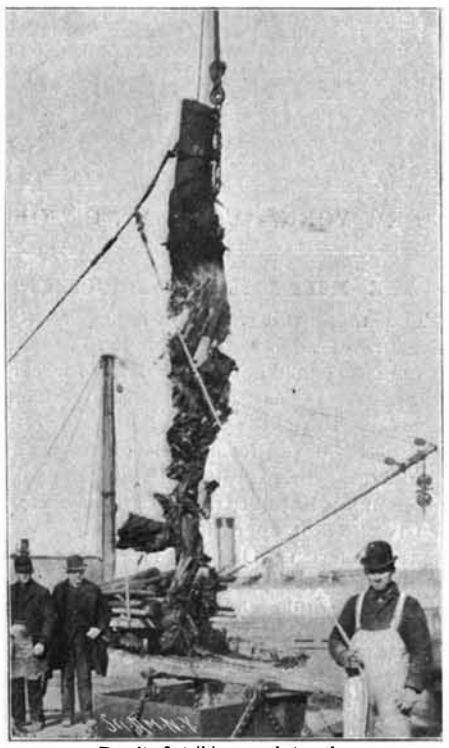
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXXIII.—No. 16. ESTABLISHED 1845. NEW YORK, OCTOBER 20, 1900. $3.00 A YEAR. 8 CENTS A COPY.

Width of floor of old dock, 50 feet; of new dock, 72 feet.

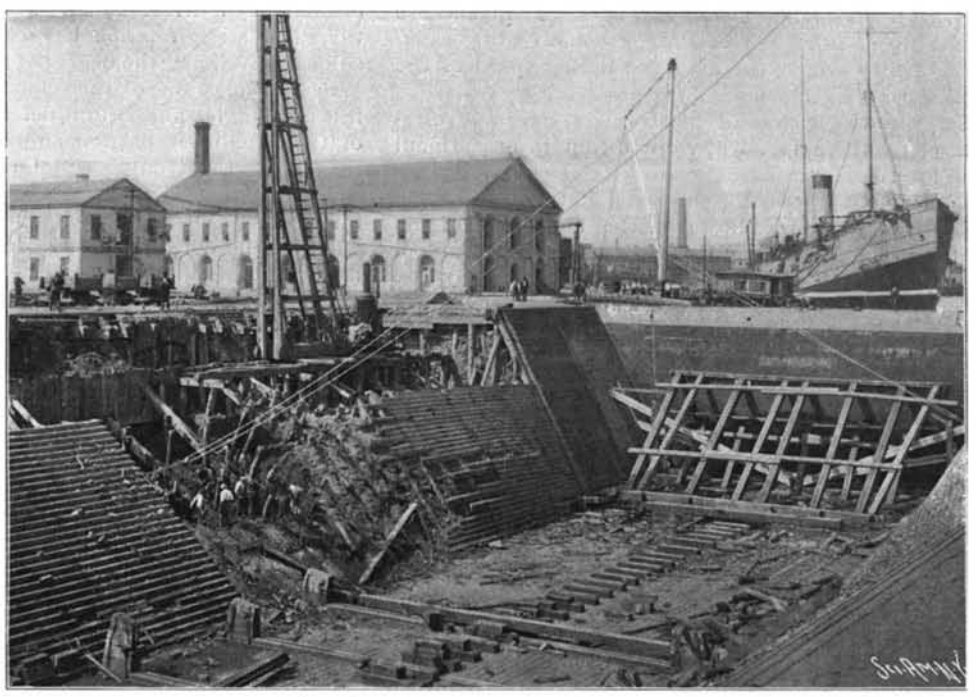
**View Showing One-half of Dock Reconstructed in Concrete.**



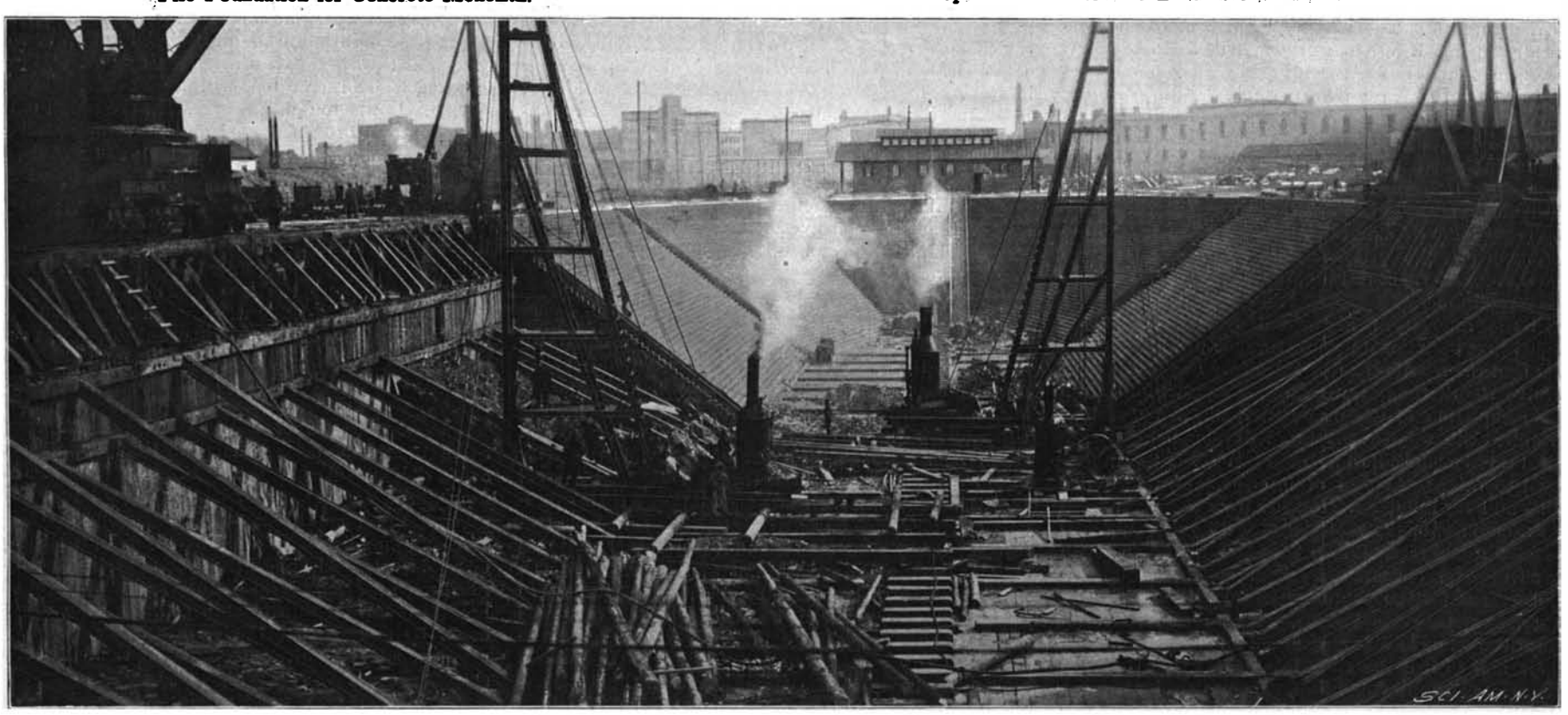
Result of striking an obstruction.

**A Pile from the Old Dock**

**Pile Foundation for Concrete Monolith.**

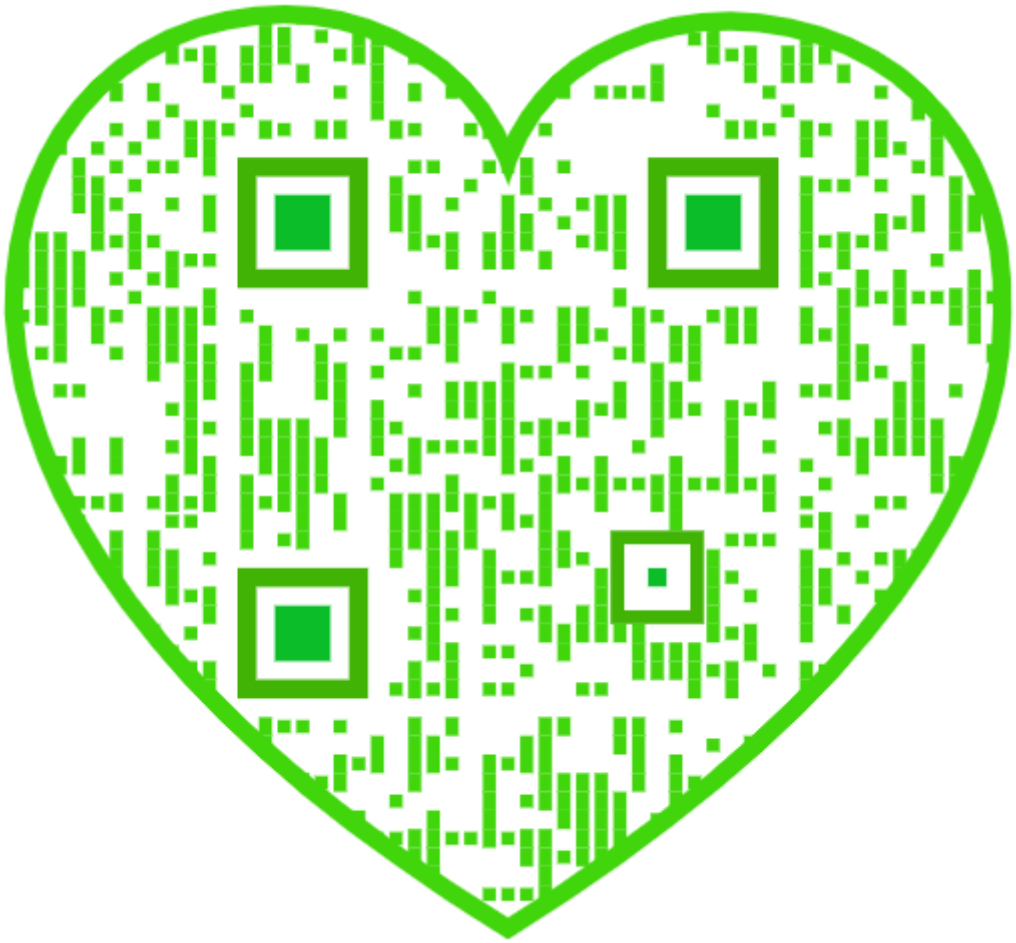


**Spot at which Side of Dock was Burst In.**



**View Showing Portion of Old Wooden Dock and the Excavation for New Concrete Structure.**

**FROM WOOD TO CONCRETE—REPAIRS TO DRY DOCK No. 2, BROOKLYN NAVY YARD.**—[See page 246.]



# Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

*TERMS TO SUBSCRIBERS*

One copy, one year, for the United States, Canada, or Mexico ..... $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

*THE SCIENTIFIC AMERICAN PUBLICATIONS.*

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, OCTOBER 20, 1900.


## THE MONO-RAIL FOR HIGH-SPEED TRAVEL.

The mono-rail railway has achieved a sufficient measure of success to entitle it to rank as a standard system of construction, at least for certain classes of work. At present the system is restricted almost exclusively to railways designed for the hauling of freight by draught animals or by manual power on plantations, or to light railways which act as feeders to the main lines of traffic. It has found its most extensive field of operation in India and some parts of South America. Only of late years has it attracted more than occasional attention as a possible means of passenger traffic, although the mono-rail line between Listowell and Ballybunion, Ireland, nine and one-half miles in length, has been for some years in successful operation. In our issue of May 5, 1900, we gave illustrations of the Langen mono-rail railroad between Barmen and Elberfeld, Germany, which must be considered as the most important development yet made in this direction. This is a double-track, elevated line, carried upon steel posts and A-frames. The trains are made up of full sized cars, each with a seating capacity of fifty people, the average running speed of the trains being twenty miles an hour.

In both the Irish and the German lines above referred to, there is no attempt to obtain exceptional speeds, the operation of both systems conforming to the common practice of suburban and light railways. Rightly or wrongly, however, the advocates of the mono-rail construction claim to see in the system special qualifications for the running of abnormally fast express trains, and, as was to be expected, some highly absurd claims have been made and impossible methods of construction and operation suggested. The proposal which is just now attracting the most attention is the construction of an express railroad between the cities of Manchester and Liverpool upon what is known as the Behr system, in which the weight of the train is borne by a central elevated rail, and the cars are guarded against excessive oscillation by means of steadying rails placed below the level of the single rail, one on each side of the structure. The first application of the company for the necessary parliamentary powers met with refusal; but it seems that another effort is to be made to obtain the necessary powers, and as the project is backed by the powerful influence of Sir William Preece, so long identified with the British Post Office, it is considered probable that it will be carried through. The "trains," which are to be electrically operated, will consist each of a single coach weighing 45 tons and seating 64 passengers. These cars are to be started at ten minute intervals, and traveling at the rate of 110 miles an hour, they will cover the distance of 34½ miles in twenty minutes. There will be no intermediate stations, switches, or crossings. In a paper published recently upon the subject, Sir William Preece seems to be perfectly satisfied that this high speed can be maintained, and that, although the fares will be slightly lower than those charged upon the standard form of railway, the enterprise will prove to be profitable.

In the interests of high-speed transit it is to be hoped that parliamentary obstruction will be removed and that the possibilities of extremely fast travel may receive the thorough testing which would result from the completion of the proposed road. No one who considers the wonderfully rapid development of electrical traction since its inception can affirm that a proposal to raise the speed of inter-urban traffic to 100 miles an hour is chimerical either from the standpoint of the engineer or the capitalist. With a properly constructed track, transmission lines and motors, a mean speed of over 100 miles an hour could certainly be achieved; and if the company, as they state, can carry passengers between Manchester and Liverpool at about the same fare as is charged on the present railroads, and in half the time, it is certain that they will secure a sufficient volume of travel to render the undertaking profitable. We do not, however, for a moment believe that the mono-rail is indispensable to the realization of extremely high speeds, for it would be possible to run a train at equal speeds over a surface road, provided the proper superelevation of the outer rail were given. The advantages of the system seem to lie chiefly in the fact that by carrying the trains well above the surface, the risks that are incidental to all surface lines on account of crossings, open gates, broken fences, etc., are entirely removed.

## THE WATER-TUBE BOILER ON TRIAL.

It cannot be denied that the disappointing results that have followed the recent wholesale introduction of the water-tube boiler into the British navy shook, for the time being, the faith of engineers in water-tube boilers as such, and caused something of a revulsion of feeling in favor of the cylindrical boiler of the well-known Scotch type. The steam engineering world has awaited with considerable interest and anxiety the official report on the subject, and now that it has been some time before the public, and there has been an opportunity to weigh the evidence, it is generally conceded that the water-tube boiler, as a type, stands pretty much where it did before, and that its relative merits and demerits have not been affected one way or the other. All that was claimed for the water-tube boiler has been realized, and its failures in the British navy are not chargeable to the boiler, as such. In proportion to its power, it is considerably lighter than the Scotch boiler; it carries considerably less water; and it possesses the advantage (scarcely to be overestimated) of enabling a ship to raise steam and get under way in far less time than was possible with the older type.

According to the memorandum submitted by the British Admiralty, the failure of the Belleville boiler is to be attributed more to the inexperience of the boiler room staff than to any inherent defects in the boiler itself. There is no denying that it has proved to be an extravagant coal consumer; but it seems that after economizers were added, and the staff had become thoroughly familiar with the management of the boilers as thus equipped, the coal consumption per horse power compared favorably with that of the ordinary cylindrical boiler. It has been found that there is a strict relation between the economical results achieved and the degree of training of the crews. When in the course of this elaborate experiment (for it is nothing less) important defects occur in any part of the machinery of new ships, the best method of remedying the trouble is jointly considered by the builders, by the dock yard officials, and by the Admiralty engineers. It becomes necessary to determine whether the defect is to be remedied by a different method of handling the machinery, or whether it calls for some radical change in the plant itself. After a decision has been reached, it is frequently necessary to delay the changes until the ship can be laid off; and even when the alteration has been made, prudence dictates that it should be generally adopted only after it has been given a trial upon one or two ships selected for the purpose. All of this takes considerable time, and progress is necessarily slow.

That the Belleville boiler is not merely valuable for strategical and tactical reasons, but compares favorably with any other type in efficiency, is shown by the recent trials of the sloop "Vestal," which, on her full power trial, with 221 pounds boiler pressure, an air pressure of 0·27 inch, and a total indicated horse power of 1,451, showed a water consumption of 16·8 pounds, and a coal consumption of 1·52 pounds per indicated horse power per hour. At five-sevenths of full power, the water consumption was 15·6 pounds, and the coal consumption fell to the remarkably economical figure of 1·3 pounds per indicated horse power per hour. At half power, with a water consumption of 15·53, the coal consumption was 1·41 pounds per indicated horse power per hour. These results, it will be seen, compare favorably with those which are now obtained on the "Deutschland," whose equipment may be taken as representative of the latest merchant marine practice. This vessel, it will be remembered, showed a full power consumption of 1·45 pounds per horse power per hour.

## THE "WISCONSIN" AND THE "VARIAG."

The builders of the "Oregon" are to be congratulated upon the fact that the excellent work which they put into that fine vessel has evidently been duplicated in the second battleship which they have built for the United States navy, the "Wisconsin." At a time when naval men were complaining of the wide disparity which existed between the speeds achieved by naval vessels on government contract trials and their subsequent performance on actual duty, the memorable trip of the "Oregon" around Cape Horn proved that this ship, at least, was an exception to the rule; and as a fitting climax to her performance, in the long chase after Cervera's squadron she showed herself to be the fastest of the battleships, and at least a match for the cruisers. Dispatches from the Pacific coast state that on her trial trip in the Santa Barbara Channel, the "Wisconsin," a sister ship to the "Alabama," whose excellent record of 17·01 knots an hour was recently mentioned in this journal, covered the trial course at a speed of 17·1 knots an hour, thereby constituting herself the fastest battleship in the United States navy. The new battleship is a vessel of over 11,000 tons displacement, and was required to show a contract speed of 16 knots with an indicated horse power of 10,000. That she should have exceeded this speed by 1·1 knots is highly creditable, and suggests that in this vessel, as in a previous warship constructed at these works, the builders have voluntarily enlarged the capacity of the engines and boilers.

Only a few days prior to the trial of the "Wisconsin," the William Cramp & Sons Shipbuilding Company achieved a notable success with the Russian cruiser "Variag," which by the terms of the contract was required to maintain a speed of 23 knots an hour for twelve consecutive hours. It will be remembered that during the first trial, held some two or three months ago, the "Variag" maintained the required speed for several hours, or until the failure of one of the cylinders necessitated postponement. On the trial recently held, the "Variag" maintained a speed of 24·25 knots for twelve hours, a performance which, on account of the duration of the test, places this speedy cruiser among the very fastest of the vessels of her class. While it is true that the two Chinese cruisers, "Hai Tien" and "Hai Chi," of 4,300 tons displacement, achieved a mean speed of 24 knots during four separate runs over the measured mile, this is certainly not more creditable than the maintaining of 24·25 knots for twelve consecutive hours.

## THE LATEST DEVELOPMENTS OF WIRELESS TELEGRAPHY.

At the recent annual gathering of the British Association at Bradford, England, Sir William Preece, who, as electrician to the English Post Office, rendered valuable service to Marconi in the introduction of his system of wireless telegraphy into England, delivered a lecture upon his own experiments in the utilization of the Hertzian waves for transmission of articulate speech without the assistance of connecting wires. The first experiments were conducted across Loch Ness in the Highlands of Scotland, as long ago as February, 1894, and they had in view the transmission of Morse signals by means of his electro magnetic method of wireless telegraphy. Two parallel wires, well earthed, were arranged one on each side of the lake, and the apparatus was so arranged that the wire could be systematically shortened with a view to ascertaining the minimum length necessary to record satisfactory signals. During the experiments an attempt was made to compare telephonic and telegraphic signals, and determine whether it was possible to transmit vocal sounds in the same manner in which the Morse signaling was being conducted. It was found that when the length of the parallel wires was reduced to 4 miles on each side of the water, it was possible to exchange articulate speech across the loch at a distance of 1½ miles.

Shortly after this, however, Marconi's practical application of the Hertzian waves occupied the attention of the electrical world to the exclusion of Preece's experiments, but in 1899, after having identified himself conspicuously with Marconi's work, Preece returned to his former investigation. His new experiments were of a more elaborate character, and they conclusively proved the fact that the maximum effects are produced when the parallel wires are terminated by earth plates to the sea itself. The conventional telephonic transmitters and receivers were employed.

At this time a scheme was in contemplation for connecting the lighthouse of an isolated group of rocks known as the Skerries with the coast guard station at Cemlyn, which is equipped with a post office telephone system. It was found, however, that the rough nature of the bottom of the channel and the strong local currents were such as to prevent the laying of a cable, and it was decided to attempt communication by wireless telephony. A wire, 750 yards in length, was erected along the Skerries, and on the mainland another line was carried from a point opposite the Skerries to Cemlyn, a distance of 3½ miles. Each line terminated with an earth plate in the sea. The average distance between the two parallel wires was 2·8 miles, and with this installation telephonic communication was easily maintained between the two stations, and the service has proved to be practical and thoroughly satisfactory.

A similar system of wireless telephony is now in course of erection between Rathlin Island, on the north coast of Ireland, and the mainland. The excellent results which have thus far been obtained prove that under existing conditions wireless telephony is a success, and may be easily and cheaply adapted to commercial needs. Although the system has not been applied to ships, there is no doubt that telephonic communication from ship to ship or from ship to shore could be carried out, the circuit being formed by means of a copper wire terminated at each end of the ship in the sea.

Another development of wireless telegraphy is that of Rosenberg, which is just now in practical demonstration at the Crystal Palace, London. His system is

similar to that of Marconi with the exception that it embodies a slight but very important alteration in the coherer. The inventor claims that he can communicate up to a distance of 2 miles without making use of the vertical wire, while with the vertical wire he can transmit messages to a distance of 40 miles. He announces that he has completed an automatic repeating device, which presumably will be installed at intervals of 40 miles. Mr. Rosenberg has also devised a modification of his system on a small scale, which should have an important commercial application. It consists of a small box containing the receiving apparatus as used in the system. When absent from his office one may receive notification of his desired attendance there by the tinkling of a small bell. The office or business house may not be aware of the wherabouts of the person whom it is desired to call up, but so long as he is no further distant from the transmitting apparatus than 2 miles, he can be notified. Mr. Rosenberg has given practical demonstration of this contrivance with distinct success.

A few weeks ago we drew attention to the application of the Hertzian waves to torpedo warfare, the invention being that of a young Englishman, who is at present successfully developing his system. The experiments described in the article referred to consisted in the successful steering of a small launch by means of the Hertzian waves. As a result of the favorable report given by Admiral Colwell, of the British government, the Admiralty have offered the inventor a large sum provided he can successfully manipulate a torpedo while it is submerged. The German government have made him a similar offer under the same proviso. We are informed that the inventor has accomplished the desired result, and that in private preliminary trials he has steered the vessel with as much ease when it is submerged as when it is at the surface of the water. The gyroscope, which ceases to have any *raison d'etre* in an electrically controlled torpedo, is removed, and its place is taken by a wireless telegraphy receiving apparatus, which, acting upon a set of magnets, manipulates the rudder.

## CALCIUM CARBIDE AT THE CONGRESS OF APPLIED CHEMISTRY.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Among the papers read at the International Congress of Applied Chemistry, recently held at Paris, those relating to the carbide of calcium industry and the production of acetylene were of great interest. The present development of the carbide industry in Europe was shown by a series of papers read by different delegates, each of which described the carbide plants of one of the leading countries. M. Minet, in his opening paper, in which he treats electro-chemical processes from a historical and an industrial point of view, mentions the carbide industry in a general way, and gives a resumé of the installations in Europe. The paper read by M. Gin gives some interesting details as to the development of the carbide industry in Austria-Hungary, where the abundance of waterfalls has led to the establishment of a considerable number of carbide plants. At present, seven large plants are in operation, and the total water power used is about 24,000 horse power. A number of projects are shortly to be put in execution, which will bring the total up to nearly 80,000 horse power.

The largest of these works, from the point of view of capacity, is that of Jaïce, which has been erected by the Bosnian Electric Company; the large falls of the River Pliva are here utilized. The river widens into a lake which discharges into a lower lake in a series of cascades. The dam has been placed shortly below the mouth of the upper lake, where the water is taken off in a canal about two miles long; the canal passes through fifteen tunnels of 12 by 15 feet section and ends in a large reservior near the station. From this point the water is brought to the turbines by two iron conduits of 5 feet diameter. The capacity of the hydraulic plant is about 9,500 horse power. Eight turbines are installed in the station, of 1,000 horse power each, connected to Schuckert dynamos. The electric furnaces for this plant have been installed by the latter company. The plant situated at Paternion is of much smaller capacity, but presents many points of interest. It has been installed by the Venetian Electrochemical Society, and is located on the bank of the River Kreuznerbach. The lime is furnished by quarries of limestone which are found in the neighborhood. A head of water of 200 feet is obtained from a waterfall in this stream; the water is brought to the turbines by canals and iron conduits to the station, situated at 1,600 feet from the fall. Here are installed three turbines, of 400 horse power each, connected directly to a triphase alternator, working at 350 revolutions. The grinding machines will pulverize 8,000 pounds of lime and 5,000 pounds of coke per day. This material is transported to an automatic balance, and thence by a conveyor to a screw mixing tank; from here it falls to the doors of the electric furnaces by a series of conduits. The mechanical operations are carried out by two electric motors. Nine double electric furnaces are used, with space for three others to be installed later; the furnaces have a capacity of 125 horse power.

The Meran works is one of the most important plants; it is operated by the Gin and Leleux process. It utilizes the water power of the Etsche, one of the confluents of the River Adige. The fall has a height of about 280 feet. The canal is less than a mile long; it passes in a tunnel for a part of the way, and then two metallic conduits, 6 feet in diameter, bring the water to the turbines; there are five of these, of the Garry pattern, with horizontal shaft. To these are coupled five alternators of 1,200 horse power each. Of these, two are used for the carbide plant, to which the current is transmitted by two cables in subway and overhead line; these furnish 2,000 horse power to the plant. A deposit of crystalline marble, very pure, is found near the works. It is carried by an aerial transporter to the calcining furnace. The lime and coke are elevated by a bucket conveyor to the grinders, passing thence to the mixers and finally by a conveyor to the furnaces. The latter have a capacity of 260 kilowatts each; they are disposed in battery in a large room 35 by 130 feet. These furnaces are claimed to give, per kilowatt day, over 11 pounds of crystallized carbide.

Among the plants shortly to be erected is that of Petrozeny. The fall of the Szill River here situated belongs to the Acetylene Company of Vienna. It is about 75 feet high at a maximum, and a mean of 4,800 horse power may be obtained. Another projected plant is that of Almissa, on the Cetina River. This large fall belongs to a syndicate, including Ganz & Company, of Budapest, the Belgium Aluminium Syndicate, and others. The fall is to be obtained by a derivation from the Cetina, using for the purpose a tunnel five miles in length, and in this way 50,000 horse power could be realized. Another fall on the same river is to be utilized by Descovics & Gin, who have obtained the concession; a head of water of nearly 300 feet is assured, which will give 6,000 horse power. A central station is to be established below the fall, and the energy to be transmitted to the port of Olmissa by the high tension system at 12,000 volts; at the latter point will be located the carbide works.

The carbide industry in the United States was the subject of a paper read by Mr. John A. Matthews, who, after giving a historical resumé of the subject, describes the Niagara and Sault Sainte Marie plants, and brings out the fact that the former works turn out most of the carbide consumed in America. He gives the selling price of carbide as varying from $70 to $90 per ton, and estimates that it requires 300 horse power for twenty-four hours to produce a ton of carbide. The cost per ton he estimates at $38. The carbide produced at Niagara is guaranteed to give 5 cubic feet of acetylene per pound, but the production of gas is usually greater. Mr. Matthews says that acetylene lighting is being extensively introduced in the Western States.

Another interesting paper was that read by M. A. Rossel, upon the state of the industry in Switzerland. Up to the time of the discovery of carbide of calcium, hydraulic power was but little used in that country, and there were only two important electrochemical works, that of Neuhausen, which utilized a part of the fall of the Rhine for the production of aluminium, and the Vallorbes plant, making various electrochemical products. The first carbide was made in the latter works, and soon after the Neuhausen plant followed its example, as also the Luterbach works. From this point the carbide industry developed rapidly, and a large amount of capital was obtained for establishing hydraulic plants for this purpose. The Neuhausen Company greatly increased its plant, and erected that of Rheinfelden; Siemens & Halske, with the Wyman Company, installed a carbide works at Langenthal, etc. M. Rossel then gave a short account of some of the leading plants. The Neuhausen works use hydraulic power to the extent of 2,000 to 2,500 horse power, from the fall in the Rhine. A part of the energy is utilized to generate direct current and another part for alternating current on the two-phase system. Both aluminium and carbide are produced at these works, which are in active operation. The Veriner factory takes its energy from the large hydraulic plant at Chèvres; it utilizes about 7,000 horse power in the shape of two-phase alternating current. The primary tension is 2,000 volts and a series of transformers reduces this to 200 volts to operate the furnaces. There are thirteen of the latter, twelve using 500 horse power, and one of 1,000 horse power. The Langenthal works was destroyed by fire on June 5 last. It was erected in 1897 by Siemens & Halske and operated by them in conjunction with the Société Electrique de Wynan. The station at the fall produced triphase alternating current at high tension, which was brought by overhead line to the carbide plant, 4 miles distant; it was transformed here to 45 volts and 3,000 amperes by three transformers.

The three furnaces installed here produced about 500 tons of carbide per year. Another large plant is that established on the River Lonza, at Gampel, utilizing two of the falls of that river. The first fall has a head of 350 feet and operates five turbines of 500 horse power each, direct-connected to low-tension alternators, while the second fall, of 680 feet, drives ten similar turbines with high-tension dynamos; the two-phase system is used. The first fall gives 2,500 horse power, which is all utilized for the production of carbide; the second fall gives 5,000 horse power, and one-half of this energy is used for the same purpose. M. Rossel describes a number of other plants, including that of Vernoya, with turbines of 4,500 horse power, 900 of which is used for carbide; Thusis, using 3,000 horse power, with twelve furnaces of 250 horse power; the Nidau plant, disposing of 5,000 horse power, and using 1,800 for carbide, etc. In the second part of his paper M. Rossel speaks of the raw material used. Limestone of very good quality is found in Switzerland, which gives lime of 99 per cent purity and containing no trace of phosphoric acid. The carbide delivered to commerce is guaranteed to give 4·8 cubic feet per pound, but generally it exceeds this by 2 to 5 per cent. Acetylene lighting is being adopted for public systems as well as in some of the factories.

## THE CONGRESS OF APPLIED CHEMISTRY AT PARIS.

The Congress of Applied Chemistry has been one of the most interesting of the series held at Paris. It is the fourth international congress relating to this subject. The first was held at Brussels in 1894, with great success, and resulted in the formation of the second, held at Paris in 1896. The third was held at Vienna in 1898. The opening session of the present Congress was held in the amphitheater of the Sorbonne. M. Berthelot was honorary president of the committee, and M. Moissan, president. M. Moissan delivered the opening address; he gave a short resumé of the history of the previous congresses, and showed their great utility. In closing he thanked the delegates from the governments and various societies for the manner in which they had answered the invitation addressed to them. M. Berthelot, who was to have pronounced the main discourse of the session, was absent on account of indisposition, and the address was read by M. Moissan. M. Berthelot went over the general history of chemical methods, and shows the ancient origin of the science. In ancient Egypt the art of chemical transformations was practised, and this art was not merely experimental, as might be supposed, but was pursued with a well defined method, as is shown by the manuscripts. It is this ancient science, transmitted partly by traditional processes, and partly by the Syrians and Arabs, who have not contributed greatly to it, which became the alchemy of the middle ages.

M. Berthelot passes over the succeeding centuries to the great discoveries of the end of the last century, which laid the way for the modern science. He laid stress upon the important role filled by the new processes of electro-chemistry, and showed how rapidly these industries were developing and what a great future was in store for this branch of the science. After the address, the officers of the Congress were nominated, these being M. Berthelot, honorary president, and M. Moissan, president. The honorary vice-presidents included more than sixty of the delegates, and all of the leading countries were represented. A great number of papers were read at the succeeding sessions of the Congress; among the most interesting were those relating to acetylene, carbide of calcium, production of ozone, production of metals and alloys by the electric furnace, methods of analysis, some of which will be reproduced in full or in abstract at a later date. At the closing session the next Congress was fixed for 1902, to be held at Berlin.

## BORAX IN EUROPE.

The greater part of the borax which now enters into European commerce is extracted from borocalcite, a mineral which is formed principally of borate of lime. It is found in great quantities in certain parts of Asia Minor. The process of treatment depends upon the reaction of borate of calcium and caustic soda, which, when added, form borax and carbonate of lime. It has been found that the caustic soda may be replaced by bicarbonate of soda to obtain the same result, the best method being to use a mixture of the two. In the process which is now generally used, the native borocalcite is reduced to a fine powder in a mill. Of the powder, 15 parts by weight are taken, and 60 parts of water, and this is placed in a steam-heated vessel, adding 8 parts of bicarbonate of soda and 2 parts caustic soda, and the whole is boiled for about three hours. The mass resulting from this treatment is passed into large filter presses, and the hot solution which comes off is placed in crystallizing basins, and at the end of a few days the borax may be collected in crystals; these are put to dry in a steam oven. They are often in irregular masses of large size, and these must be broken into small pieces, after they have been well cleaned. The small crystals thus obtained are assorted and put in barrels whose weight is from 100 to 800 pounds. The cake of carbonate of lime which remains in the filter-press is washed with water until the borax is completely extracted, and is then sold to glass, paper or cement works. It is estimated that 100 pounds of borocalcite will yield 100 to 105 pounds of crystallized borax.

## A NEW MILITARY FOLDING BICYCLE.

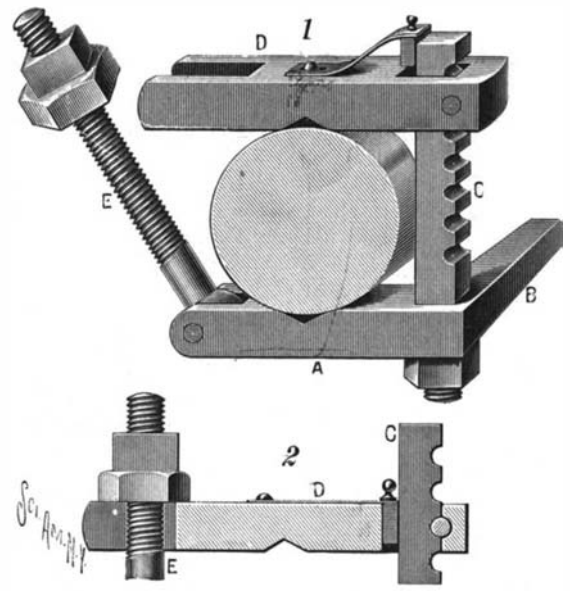
The bicycle as a supplementary fighting unit is rapidly making headway in the various armies of the world. For years it was regarded more as a toy than an efficient mount, and consequently the nations, absolutely unaware of the capabilities of the machine for military purposes, did not regard its introduction with favor. But its advantages have now been so forcibly emphasized that those very people who at one period regarded it with resentment are now foremost in their recommendations for employing it upon the battlefield. For certain military duties, such as scouting and conveyance of dispatches, the cycle is absolutely without a rival. It is noiseless, occupies small space, and consequently offers but a very insignificant target to the rifle fire of the foe, offers great mobility, and is absolutely reliable.

In England recently, an army of cyclists numbering about 2,000 men in all was organized for the purpose of determining how far it would be possible for an army of such mounted men to temporarily repel the advance of an invading army until the main army were able to arrive and fight a pitched battle. It was supposed that the foe had landed on the southern coast of England and were advancing on London by the thirty-six roads leading to the metropolis, since the railways had all been destroyed. The cyclists had to dispute the advance of the foe, and they accomplished the object in such a convincingly formidable manner that their utility has been thoroughly established.

Other nations have also been equally zealous in introducing the cycle into their respective armies. France, Germany, Italy, Belgium and Russia all possess military cycling detachments, and recently the Japanese have made the innovation in their army. In the majority of the cases, however, the cycle generally employed is of a collapsible design. That is to say, the machine is so constructed that by means of some simple operation it can be folded up into small compass and be slung upon the back of the rider, out of the way. To satisfactorily accomplish this desideratum with the existing type of machine, however, is a very difficult matter. The majority of the devices by which the cycle may be folded are based upon the idea of hinging the frame in some manner. This principle, however, destroys the rigidity and strength of the machine to a very appreciable degree.

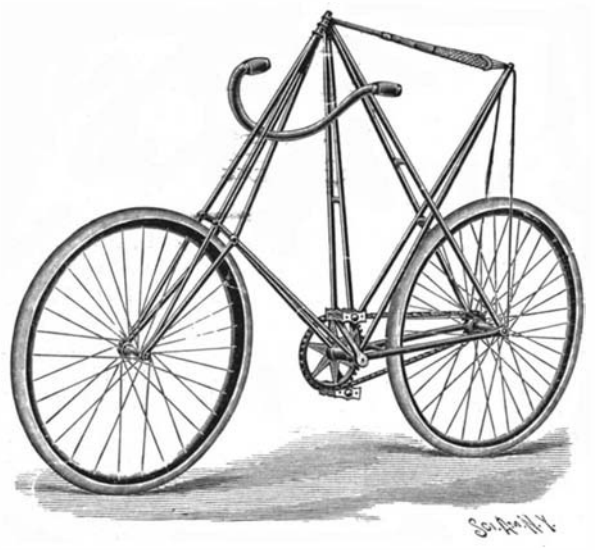
But a military cycle has now been devised which is said to be stronger, more rigid and lighter than the conventional type of machine; and lightness commensurate with strength and rigidity in a military cycle is a great recommendation toward its utility upon the battlefield.

It will be recognized that the frame is constructed upon the system of triangles, which principle is the most conducive to stability. The tubes of the frame are doubled throughout, whereas in the existing type of cycle they are single. A very important improvement is the front section of the frame, carrying the steering wheel. There is no fork. As is well known, this is one of the most serious defects inherent in the present diamond frame, since the system of triangles has to be abandoned somewhat in the front head. But in the Dursley-Pedersen this defect is efficaciously surmounted. There are a pair of tubes springing from the hub of the front wheel on either side to the head of the frame. The front tubes on each side are perfectly straight, but the second tubes are drawn back in the center, and an open steel crown plate holds all four in position. From the head of the machine the tubes dropping to the crank bracket are placed almost vertically, while from the crank bracket two more tubes spring to the front fork, holding it firmly in position. From the head also drop the tubes to the hub of the back wheel, and another pair of tubes radiate from the crank bracket to carry the saddle, which is one of the most conspicuous features of the whole machine. It does not consist of a shaped leather seat securely fixed upon a saddle pillar, but is a seat suspended hammock fashion between seven spiral springs attached to the adjustable saddle pillar and the top front fork, to which it is secured by means of a strap, which can be adjusted so as to tighten or to slacken the saddle as desired. The recommendation of this unique saddle is that it adjusts itself to every movement of the body, and allows perfect freedom to those muscles which cycling brings into play. By this means perineal pressure is entirely averted, while perfect ventilation, ease, comfort and softness of seat are assured. As the strain between the saddle pillar and the hub of the back wheel is purely tensile, they are connected on each side by wires in place of tubes. The joining of the tubes throughout the machine is accomplished by sweating instead of the more general brazing, the former method being considered to be stronger. The handle bar is passed through the front tubes, and is fixed at a low elevation, the handles curving upward to the desired height.




THE SCHELLENBACH COLLAPSIBLE LATHE-DOG.

Some idea of the strength of this principle of construction may be gathered from the fact that the inventor's original machine was built of poplar sticks, in lieu of the steel tubes, secured together with twine, and represented a total weight of 18 pounds. Yet this machine, primitive though its construction is, has been ridden no less than 5,000 miles without the slightest mishap, and is still in use.



THE DURSLEY-PEDERSEN MILITARY CYCLE, SHOWING PRINCIPLE OF CONSTRUCTION OF FRONT FORKS.

The cycle is folded by slipping out the front wheel and tubes at the head and at the point where the two tubes radiating from the crank bracket join the front tubes. The front wheel then folds back upon the back wheel and is kept in position with a strap. It takes but twenty seconds to perform the operation and to sling it upon one's back, and it can be as readily put together again. The total weight of the machine, which is constructed of steel throughout, is only 15 pounds. Indeed, it folds up so compactly that one can climb obstructions and perform the ordinary military duties with the greatest facility and without the slightest inconvenience. The rifle is fixed vertically in a slot on the frame of the front wheel.

FOLDING BICYCLE, WITH RIFLE ATTACHED. WEIGHT, 15 POUNDS.

BICYCLE FOLDED AND CARRIED UPON RIDER'S BACK.

## A COLLAPSIBLE LATHE-DOG.

A lathe-dog which can be more conveniently and securely fitted to the work than dogs hitherto used, and which can be adjusted within a wide range, is the subject of an invention which George W. Schellenbach, of Joplin, Mo., has recently patented.

As shown in our illustration, the lathe-dog has a base, *A*, which constitutes a fixed jaw. From one end of the base or jaw, *A*, a tail, *B*, projects, which is to be used in the ordinary manner. Passing through one end of the jaw, *A*, and provided on its lower threaded end with a nut, is an arm, *C*, formed with notches. The arm, *C*, passes through an opening in a movable jaw, *D*, provided with a pin designed to lie in any one of the notches of the arm, *C*. A key carried by a spring secured on the movable jaw, *D*, extends into the opening mentioned and wedges the arm, *C*, and the jaw, *D*, rigidly together. The end of the jaw, *D*, is slotted to receive a screw, *E*, pivoted to the fixed jaw and provided with a duplex locking nut. By means of this nut the jaw, *D*, is forced down toward the jaw, *A*, since a slight rocking movement is permitted by the pin lying in the notch of the arm, *C*. The working faces of both jaws may be recessed to hold the work securely.

It is evident that the dog can be easily taken apart and packed in a very small space and that its range of adjustment is wider than that of ordinary dogs.

### Petroleum in Japan.

The petroleum industry has reached a considerable development in Japan, as may be remarked from the reports recently published in The Japan Times relating to the province of Echigo. In this district as many as thirty companies now exist, some of these representing a capital of more than half a million, while the total capital engaged in the petroleum industry in this region is estimated at more than six millions. As an indication of the activity which now prevails in the petroleum region, it is stated that two of the principal banks of Japan are about to make branch establishments in the cities of this district. There is some talk of installing a pipe line from the district of Echigo to Tokio, upon about the same plan as that now established in the Caucasus region. The plans for this work are soon to be drawn up, and it is to be directed by M. Miyagi, a prominent Japanese engineer, who is a graduate of the engineering college of the Imperial University of Tokio.

### The Torpedo Boat "Bailey."

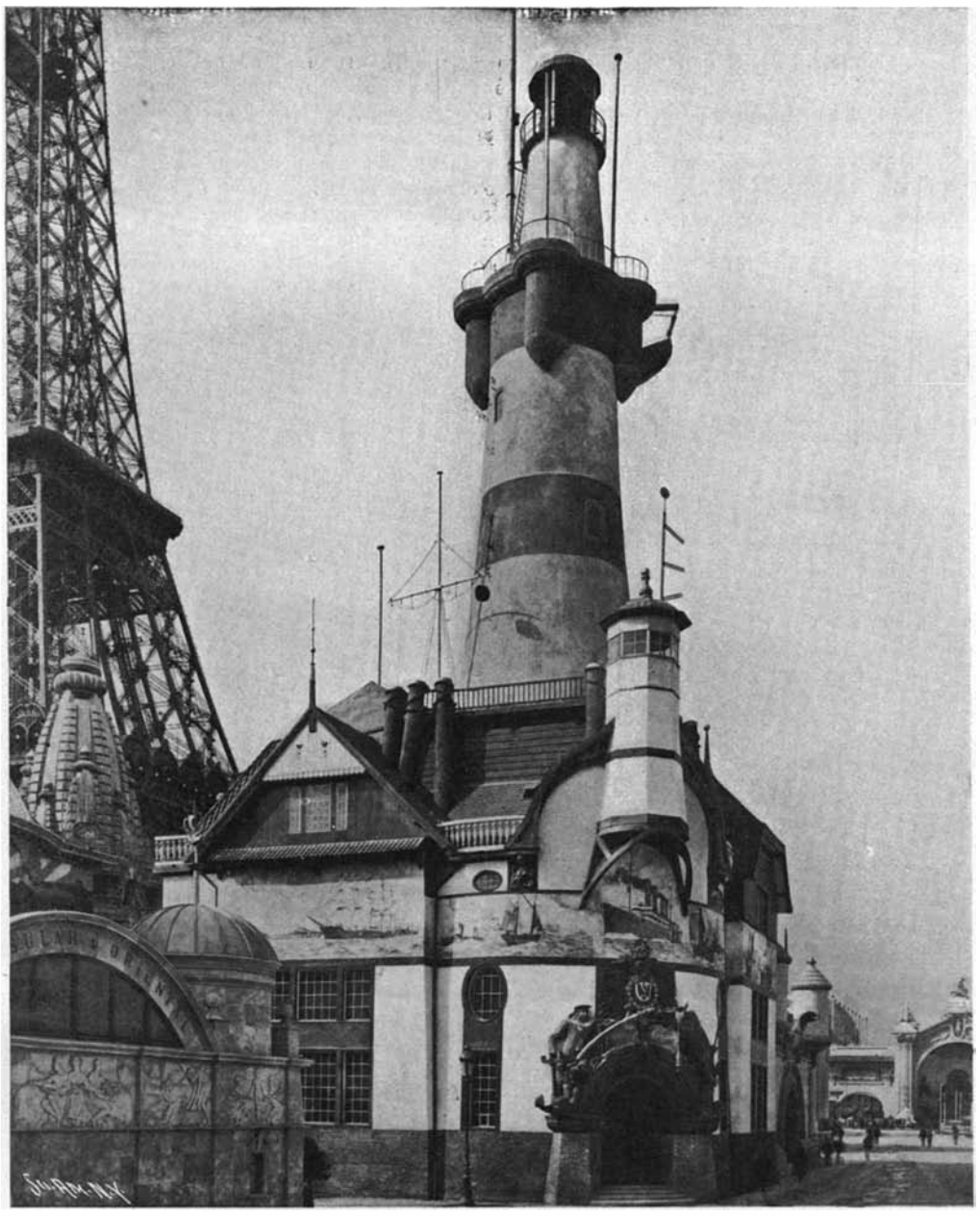
The torpedo boat "Bailey" had her builders' test on the Hudson River, at Yonkers, September 17. She made 30 knots, and it is thought she will show 32 knots on her official trial trip. Her contract calls for 30 knots. The builders' trial was made at a pressure of 165 pounds of steam and she developed a little over 5,000 horse power. Her capacity is in excess of 6,000 horse power.

DURING some excavations in the Forum at Rome, the laborers unearthed the head and part of the body of a marble horse. It is a magnificent piece of sculpture, and great value has been placed upon it. According to experts, the relic dates from about the second century before Christ.

**PARIS EXPOSITION—BUILDING OF THE GERMAN MARINE.**

At one end of the Champ de Mars, near the Seine, is the picturesque building which has been erected to represent the German marine. The photograph gives a good idea of its general appearance. The main portion of the building is in characteristic German style, and is decorated with marine emblems. The walls are finished in white staff, with an ornamental border in fresco representing various forms of steamships and sailing vessels. At one corner is an arched entrance, above which are two sailors in relief, each with appropriate emblems, supporting the national coat of arms. Above the main doorway is a small tourelle in the form of a lighthouse, carrying above a system of semaphore signals. The building is surmounted by a tower which rises to a considerable height, representing one of the German lighthouses; it is painted alternately white and brick red; a platform near the top is upheld by four projecting turrets, and from this rises the upper portion supporting the cupola, in which has been installed a powerful arc projector of the Schuckert system; from this elevated point it sends its rays to all points of the Exposition grounds.

The building has three stories, not including the lighthouse. On the first floor are a number of exhibits of great interest covering a variety of subjects pertaining to marine architecture and life-saving apparatus. There is a large globe of bronze, about 12 feet in diameter; upon it the continents are represented in silver and the sea in light blue, while the routes of the principal German navigation companies are traced by lines of different colors. The genius upholding the globe is in repoussé bronze, as are also the handsomely executed figures beneath the globe. The total height of the globe from the floor is about 30 feet. Around the base are the signs of the zodiac represented in relief, and a series of tablets bear the names of the prominent navigation companies. Another illustration shows a model of the large office building of the North German Lloyd erected at Bremen; it was designed by the architect Poppe, of that city. The model is executed in plaster, and measures about 7 feet square at the base; under the model are a number of photographs showing interior views in different vessels of the company, and below these are a number of small models representing the principal vessels; among the largest of these may be mentioned the "Kaiser Wilhelm II.," the "Friedrich der Grosse," etc. The great number of models shown indicates the size of the company's fleet. In front of each vessel is a card giving the principal dimensions and data. Not far from this is to be seen a partial section of the new steamer "Deutschland," executed in one-third natural size. The front is arranged to be flush with the wall, and the spectator looks into the interior of the vessel. The main gallery is thus seen, with its three decks and its upper dome of stained glass; below is represented the main dining saloon, with all its fittings reproduced in miniature; red is the prevailing color of the upholstering and tables; upon the latter are numerous incandescent lamps. The gallery above is finished in hardwood and bronze; the finishing of the different saloons is shown, and the whole gives a very good idea of the interior arrangement of the vessel. On one side is a large model of the same vessel, which measures about 12 feet long; it is finely executed in all its details. Near it a model of about the same size shows the "Kaiser Wilhelm der Grosse" of the same company; a smaller model, about 8 feet long, shows the "Friedrich der Grosse." The different war vessels are also represented by a number of models of smaller size; among these may be mentioned the armored cruiser "Weissenburg," also the "Yakumo," built for the Japanese service. These two vessels were built at the Vulcan Works at Stettin. The first-class battleship "Karl der Grosse" is represented by a model of fine workmanship, showing the details of the armament.



PARIS EXPOSITION—PAVILION OF THE GERMAN MARINE.

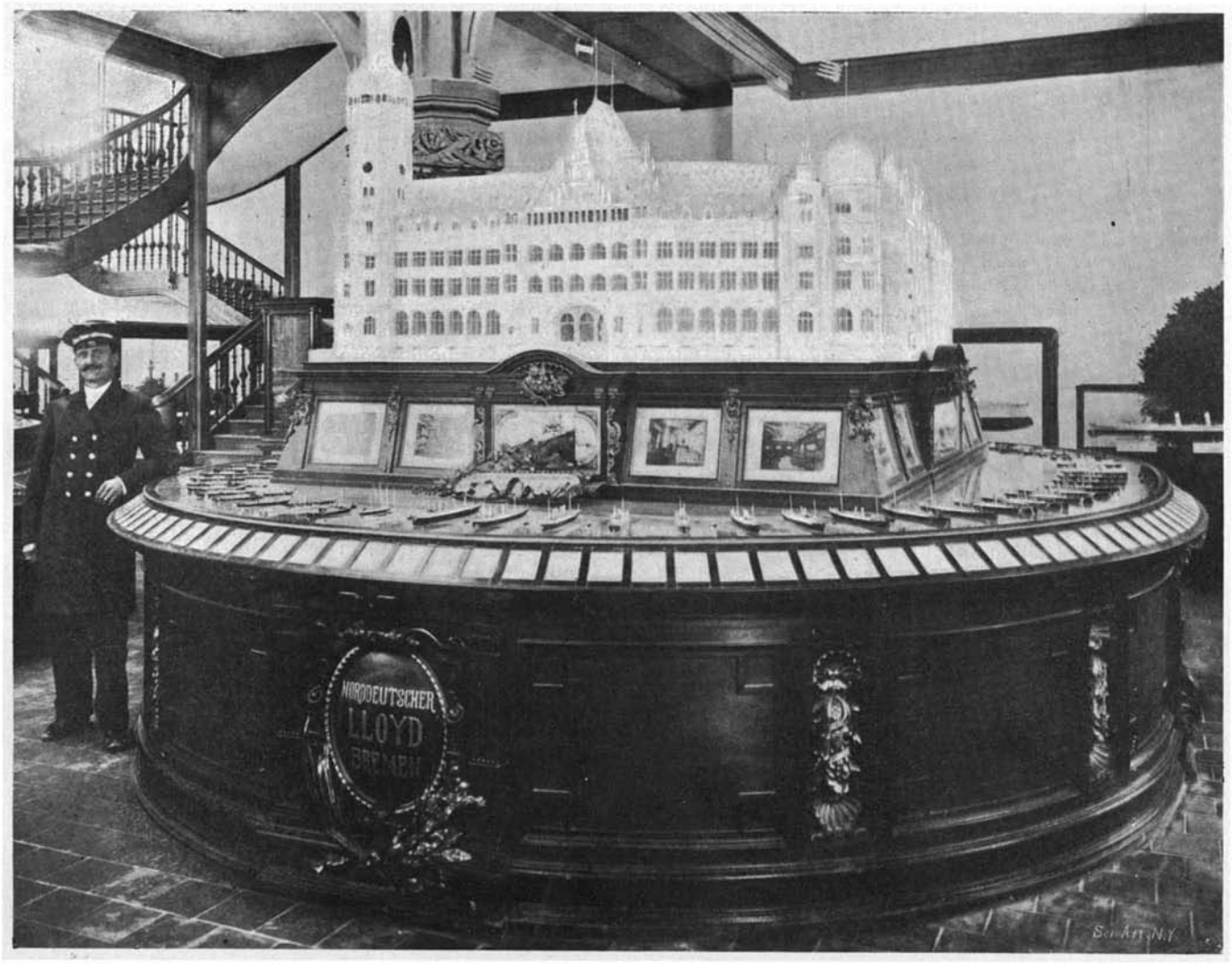



EXHIBIT OF THE NORTH GERMAN LLOYD—PAVILION OF THE GERMAN MARINE.

The floating dock at Hamburg, of 17,500 tons, constructed by Blohm & Voss, is represented in miniature; it carries a derrick crane of 150 tons. Upon the dock is the steamship "Potsdam"; a portion of the quay is seen, united to the dock by a number of bridges; a railroad runs along the water's edge. Another model shows the operation of lengthening out the government postal steamer "Preussen" upon a floating dock, and the method of putting in the intermediate pieces; at the same time the interior arrangement of the vessel may be observed. An interesting collection consists of a number of torpedo boats, constructed for the different governments by the Schichau works at Elbing. Among these is represented one of eleven torpedo boats of 27 knots built for the Russian marine, and another of 30 knots for Italy. A number of types constructed for the Japanese, Russian, and Chinese marine are to be seen, and torpedo cruisers built for Norway and Austria. The Vulcan docks, of Stettin, have also a number of models, among which may be mentioned the armored cruiser "Hertha;" the cruiser "Bogatyr," built for the Russian government, is also shown.

On the second floor one of the main objects of interest is a large model of the port of Hamburg, built upon a platform. The buildings and streets of the city and the different docks with their vessels are well represented, giving a good idea of the large amount of shipping handled by this port, which has become one of the most important of Europe. Near it is a model of the boat which is to be used in the Antarctic expedition which is to take place next year; the boat is represented in $\frac{1}{16}$ scale. Its actual length is 138 feet, with a maximum width of 36 feet; it has 1,442 tons displacement. The engines are designed to furnish 275 horse power. This boat has been built at the Howaldtswerke at Kiel. Among the other models to be seen on this floor may be mentioned those of the principal yachts of 1899. besides a number of other vessels. On the third floor is seen the floating crane, "Turgud Alb," built for Constantinople by the Bremen Company, and the armored cruiser "Victoria Louise." A number of collections of ships' instruments are shown here; Schaffer & Budenberg, of Magdeburg, have an extensive exhibit of marine pumps and valves. Different forms of diving apparatus are to be seen, and several improved forms of divers' suits.

## RECONSTRUCTION IN CONCRETE OF DRY DOCK No. 2, NEW YORK NAVY YARD.

The reconstruction of Dry Dock No. 2 of the New York navy yard, Brooklyn, affords a striking object lesson as to the defects of wood and the advantages of masonry in this kind of structure. The choice of timber in dry dock construction was determined entirely by considerations of cheap first cost; for not even the most sanguine advocate of wooden dry docks has suggested that they would compare in economy of maintenance and repairs with the stone docks.

Dry dock No. 2 was built in 1890, and after a useful life of only nine years, it has failed so completely as to render its entire reconstruction desirable. Compare this with the record of the adjoining dry dock No. 1, a granite structure, which is just as good to-day as when it was opened over half a century ago.

On more than one occasion we have described the constructive features of wooden dry docks, and the reader is referred to the illustrated article in our issue of February 20, 1897, describing the big dry dock officially known as No. 3.

Apart from the serious objections to wooden dry docks on the score of their rapid decay and the need of constant renewal, either in part or in whole, their construction is such that they are but poorly adapted to withstand the heavy hydrostatic pressure to which they are subjected when dry. The floor and walls of the wooden dry dock are nothing more than a comparatively thin shell of wood, bolted down upon a mass of piling which has been driven over the whole area of the dock; and while they are fully able to withstand the outward pressure due to the weight of a ship when the dock is empty, or of water when it is full, they are entirely unsuited to withstand the inward thrust of water which may get in behind the altars and beneath the floor when the dock is pumped dry. In the case of a large dock 30 feet in depth, the hydrostatic pressure tending to burst in the floor and lower walls will approximate one ton to the square foot. Such a disaster is guarded against by driving several walls of sheet-piling entirely around the dock; but it frequently happens that carelessness in driving the piles, or the presence of obstructions underground, will cause a break in the continuity of the sheet-piling, and permit the accumulation of water behind the altars.

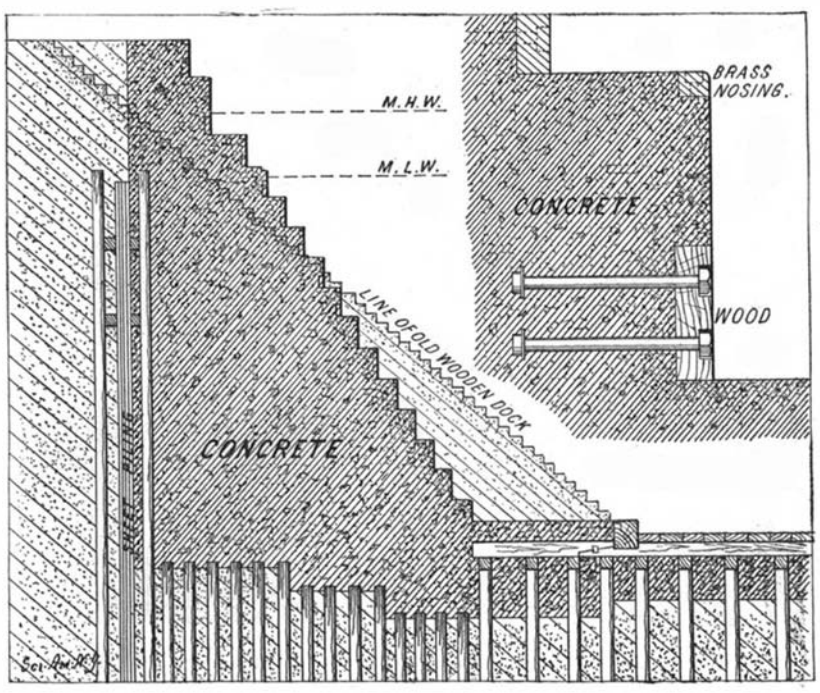
In the case of the dock now under consideration, it seems that during a heavy and prolonged rain storm last year, the culverts proving insufficient to carry off the storm water, it flowed over the surface of the navy yard and collected behind the walls of the dock, which proved unequal to the strain upon them, and bulged out at the point shown in one of our first page illustrations, to the extent of several feet, breaking off the 12 × 12 caps, and generally wrecking the structure over a considerable portion of its area. It was decided that the most satisfactory way to repair the damage would be to reconstruct the walls of the dock in concrete.

In carrying out the repairs, the steps, or "altars," as they are called, were first stripped to the level of the lower guide-wales of the sheet-piling, as shown in the lower engraving of our first page, and the backing was excavated to the same level. The wall of sheet-piling was then driven, the piles penetrating to a depth of 54 feet from the ground level. The stripping off of the timber structure and the excavation of the backing was then carried down until it was possible to put in position the shoring timbers, which will be noticed extending from the longitudinal wales to the old sill or bottom altar at the floor of the dock. The excavation was then carried down to the floor level and round piles were driven over the whole surface, the distance from center to center of the piling being 2 feet. The piles were then cut off about 6 inches above the ground, as shown in the accompanying transverse section of the dock. On this foundation, as thus formed, was built up the concrete monolith, its outer face abutting against the wall of the sheet-piling and its inner face being stepped into altars. It was originally intended to build the altars of granite; but to avoid the delay that would be caused by waiting for the delivery of the granite, it was decided to build them of concrete. To protect the altars, 1½ by 2¼-inch brass nosing-strips were laid along their edges, and 3 by 12-inch pine fender-strips were let into the risers, as shown in the accompanying drawing.

It will be noticed that the slope of the side walls of the concrete dock is considerably steeper than that of the old structure, the two being in the ratio respectively of 2 to 3 and about 1 to 1. The result is that the new dock has a form which is very much better adapted to the docking of ships, inasmuch as it gives more room (22 feet on the floor) where it is greatly needed, and brings the upper edges of the dock closer to the sides of the ship—advantages which greatly facilitate the handling of material and the general operations connected with dry dock repairs. The old floor of the dock was left undisturbed between the side sills, but the transverse timbers were extended beneath the concrete for the full width of the new floor, in order to give increased transverse strength to withstand the upward thrust due to hydrostatic pressure.

The concrete monolith will be extended entirely around the dock to the inner of the two grooves provided for receiving the caisson gate. Here the timber groove will be replaced by one in granite. It is fortunate for these repairs that the dock was designed with outer and inner grooves, since by placing the caisson at the outer groove and shoring it from the floor of the dock, as shown in one of our first page illustrations, it was possible to build the new granite groove without any further preparation. Had it not been for this circumstance, it would be necessary to build a heavy cofferdam across the entrance channel, whose cost would have added greatly to the total cost of the reconstruction. Advantage has been taken of the opportunity offered by the construction of the new groove to build a new caisson and enlarge the entrance to the dock, the enlarged caisson affording an entrance 72 feet wide on the bottom as against 53 feet, while a gain in width of 5 feet has been made at the coping, and a gain of 6 inches in the depth over the sill. The result of these changes is that the reconstructed dock will be capable of accommodating any ship in the United States navy.

When it is stated that the cost of these repairs will be about $600,000, it might seem that the advantages which we have outlined above were purchased at a rather dear figure; but when we consider the relative cost for repairs of masonry and timber docks already in existence in the United States navy, it will be realized that the more durable structures are, in the long run, the more economical. The figures furnished by the Bureau of Yards and Docks show that during the seven years from 1892 to 1899, the repairs on the three stone docks at Boston, New York and Norfolk amounted to only $4,543, whereas the repairs on the three timber docks at New York, League Island and Norfolk amounted during the same period to no less than $426,073. The reconstruction of the dock has been carried out under Capt. P. C. Asserson, C.E., to whom we are indebted for courtesies extended in the preparation of this article.




Cross-Section Through Side Wall of Old and New Dock, and Detail of Altar Protection.

NEW CONCRETE DOCK, BROOKLYN NAVY YARD.

### A New Use for Fogged Plates.

Dry plates that have been fogged before exposure in the camera by some means or other, can be utilized for the production of transparencies. Take the fogged plate and expose it to lamplight for a few minutes, in order that it may be fogged evenly all over. Then immerse it in the following solution:

| | |
|---|---|
| Copper chloride | 350 grains. |
| Potassium bromide | 42 " |
| Water | 16 ounces. |

The plate should be left in this bath for about ten minutes, and then thoroughly washed in water. The whole of the operations may be performed in orange light. When dry the plates are comparatively insensitive. To print, the plate is placed behind the negative in the printing frame in the usual manner, and with a negative of average density an exposure of from twenty to thirty seconds may be given in diffused daylight; or from two to five minutes at a distance of about twelve inches from an ordinary lamp or gas burner. Any developer may be used, but care should be exercised to use rather a large proportion of bromide.

## Correspondence.

### The Color Screen for Astronomical Telescopes.

To the Editor of the Scientific American:

The article on the subject of the color screen in the issue of the Scientific American of September 22 contains some statements which are not in accord with the historical facts in regard to its development, and some conclusions in regard to the results which are premature, if not erroneous. I am glad, in the interests of scientific and historical accuracy, which the Scientific American always aims to serve, to give fuller information in regard to the facts of the case. The color screen for the purpose described can hardly be called an invention, but an application to visual telescopes of a device well known in photography, but used for a somewhat different effect. Its use on the 26-inch equatorial of the Naval Observatory was the result of successful experiments made by Prof. See and Mr. Peters to remove the violet-blue halo caused by the secondary spectrum, which is a source of annoyance in all large achromatic refractors. While its use for this purpose is effective, it ought not to be inferred that it causes a decided improvement in bad definition of the image due to atmospheric condition. It would also be premature to assert that the experiments show such decided effect in the reduction of the diameters as are indicated in the article in question, until further measurements shall have been made by other observers both with and without the color screen, in order to remove the probability of systematic personal error to which all observations of this kind are peculiarly subject.

At the time of the publication in the Astronomische Nachrichten, in April, 1900, of the description of the color screen and the preliminary results obtained by its use on the great equatorial of the Naval Observatory, it was thought that the matter was entirely new. The editor of that journal, however, in an editorial foot-note, called attention to a previous successful investigation of the same character as follows:

"Concerning earlier successful attempts to eliminate the secondary spectrum, compare M. Mittenzwey, Astronomische Nachrichten, 2523 and 2524, 'On the Absorption of the Secondary Spectrum in Large Refractors.'"

These earlier investigations do not appear to have been generally known, and the use of the color screen does not appear to have been carried beyond the experimental stage or practically tested by use on an instrument of large dimensions. A reference to Mittenzwey's communication on this subject in the Astronomische Nachrichten, 1883, shows, however, that he fully appreciated its advantages, as will be seen by the following brief quotation:

"A thorough spectroscopic investigation of the absorption of a large number of colored media has finally resulted in an extremely simple method, by which the secondary spectrum in the achromatic telescope is so far removed as to be imperceptible in an instrument of 6 inches aperture and 60 inches focal length with 400 magnifying power, while the brightest colors of the spectrum suffer thereby no perceptible diminution in intensity. The image of a bright star is shown . . . as a little disk surrounded by a few diffraction rays, yet completely free from the strong violet-blue halo which in instruments of large dimensions forms such an objectionable feature. Upon the disks of planets, details of delicate markings are rendered distinct which otherwise are seen only with difficulty.

"The contrivance consists of a capillary fluid cell of blue-green fluorescent derivative of resorcin, fluorescein, which is inserted in the cone of rays close to the ocular system.

"A very weak alkaline solution of the same in glycerin, which will not dry up, was inclosed in a capillary cell of two plane parallel glass plates, and this cell in turn was fastened onto the plane surface of the field lens by a film of oil, or else to the cap of the eyepiece."

By giving the above statement due publicity you will greatly oblige S. J. Brown,
Prof. of Mathematics, U. S. N. Astronomical Director.
Washington, D. C., October 9, 1900.

At Altoona, Pa., the Edison Electric Illuminating Company strings its wires with the aid of an electric motor, which is carried by a truck. The current for the motor is obtained by tapping the company's three-wire system. The motor drives an ordinary stonemason's crab. The speed is reduced by a countershaft, which gives a rate of rope travel of 40 feet per minute. A ¾-inch rope is used and a small four-jaw home-made clutch, to which the wire is fastened. The wiremen have no difficulty in pulling up 3,000 feet of large bare copper wire a day on street work, says The Electrical World.

### Science Notes.

The Rothamsted experimental station, which was established by Sir John Bennet Lawes, was given to the nation before his death.

Lieut. Amsdrup's polar expedition has just returned. He examined and charted the region from Cape Dalton to Aggas Island, and thus obtained a chart of the whole coast of East Greenland from Cape Farewell to Franz Josef Land.

The failure of the "Windward" to return from the Arctic regions is thought to denote the fact that the explorer will not attempt to return this year. It is probable that the season was an open one in the far North, and if this was the case Lieut. Peary may have taken the "Windward" into some high latitude, hoping to use the vessel in an expedition next season.

Helen Keller, the interesting blind and deaf mute, has passed the entrance examination to Radcliffe College. She has chosen the French, English, and German courses, and in addition the course in history. The examination papers were made out, using the raised point system, and she wrote the answers upon a typewriter. At the lectures she is accompanied by Miss Sullivan, who sits close behind her and gives her in the manual language whatever the instructor may be saying.

Prof. Robert Koch, the famous bacteriologist of Berlin, has returned to Europe. He has been conducting scientific investigations in the German colonies for a year, and has now reached Hong Kong. He states that he has discovered means for preventing the spread of malaria in malarial districts, and has found means of extirpating it. His experiments in this line were conducted in New Guinea, where large numbers of natives die yearly of malaria. He prescribes a medicine the chief ingredient of which is quinine. It is said to be both curative and preventive. He also found it necessary to expel the parasites of malaria. Details are not given as to how this is accomplished, but it is known that he has carried on investigations upon the transportation of the malarial germ by mosquitoes. He considers that in temperate climates it will be more easy to stamp out malaria than in tropical climates. His investigations will be completed in his laboratory at Berlin.

When O. Lehmann announced his discovery of liquid crystals, ten years ago, he was greeted with a chorus of doubt and disapproval, but he has since succeeded in proving that all the characteristics of crystallization which his liquid crystals do not possess cannot logically be made part of the definition of a crystal. The only general characteristics of crystals are that they are not isotropic, and that they possess a molecular directive force which governs their shape and the distribution of accretions. The directive force is preserved by means of the surface tension, and crystals may, therefore, be liquid or solid, but they cannot be gaseous. Liquid crystals may be produced by depositing solid crystals from a mother liquor on the cover glass of a microscope and gently heating the latter until the fusing point is exceeded. Their optical properties can then be conveniently studied. Their double refraction and dichroism indicate a difference in the dielectric constant and the electric conductivity respectively in different directions, but these differences cannot be placed in evidence owing to the electrostatic rotations which free crystals immersed in a liquid undergo in an electrostatic field. In a magnetic field, however, the crystals show a distinct tendency to place their axes of symmetry normal to the lines of force. The author expects to obtain valuable results by applying this discovery to living cells.—O. Lehmann, Ann. der Physik.

Two Frenchmen, M. Balsan and M. Godard, recently made an ascent in a balloon at Vincennes with a view to reaching the greatest altitude that could possibly be obtained. They did not succeed in lowering the record, however. During their journey they kept a record of their impressions and sensations at various heights. They first began to experience the nauseating effects of the rarefied air at 18,200 feet, when their temples ached and their vision was blurred. At 20.150 feet M. Balsan was rendered so ill that he could neither speak nor reach his bag of oxygen, and had to be attended by his companion. Shortly afterward the latter was somewhat paralyzed and could only move with difficulty. But with the application of oxygen they were restored, and they were but little inconvenienced. At 21,450 feet they described the cold as being intense, and that their beards were covered with ice. When 22,400 feet was attained, they were rendered so helpless, and the pain was so great, that they could hardly gather sufficient strength to open the valve of the balloon. When they reached the ground, they were in a very exhausted condition. Dr. Berson, in company with Mr. Arthur Spencer, ascended some months ago from London to a height of 27,500 feet, while Messrs. Coxwell and Glaisher ascended to the height of 35.000 feet, at which altitude one of the travelers was rendered unconscious, while the other only just succeeded in opening the valve by pulling the rope with his teeth.

### Engineering Notes.

At the new Orleans station, at Paris, a most elaborate system of traveling ramps has been devised for the transportation of baggage about the building. The pieces are taken from the low level of the tracks and are hoisted to the baggage room, where they are discharged at sorting tables.

There have been several instances in steel works of workmen being poisoned by water gas, which consists largely of carbon monoxide. The only remedy hitherto known has, we believe, been the transfusion of blood, but another is now announced by M. A. Mosso in a note to the Comptes Rendus of the Paris Académie des Sciences. Unfortunately, the remedy is not an easy one to apply, as it consists in putting the victim in an atmosphere rich in oxygen and under pressure. Thus, of two monkeys, both poisoned by carbonic oxide, the one left to its own resources died, while the other, being placed in an atmosphere of oxygen at a pressure of 30 pounds per square inch, recovered completely in half an hour.

In the course of the additional forthcoming trials by the English Admiralty with the old hulk of the "Belleisle" the naval authorities will endeavor to ascertain the resisting qualities of Krupp armor under varying conditions. One side of the vessel will be armored for a length of 20 feet with 6-inch Krupp armor, and on the other side a similar plating of 4-inch Krupp armor. Projectiles will then be fired at these plates from the different guns of a first-class battleship, at varying ranges, and the results will be carefully observed by the representatives of the Admiralty watching the tests. The work of plating the vessel for these experiments is now in progress, and it is estimated that two or three months will elapse before she will be ready.

In a letter to The London Times, Sir W. B. Richmond, president of the Smoke Abatement Society, states that there are about 18 million tons of coal consumed annually in London, costing some 16 millions sterling, of which probably 3 million tons are consumed by gas and other manufactories. About two-thirds of the heat produced by the combustion of coal is lost in the ordinary grates by passing up the chimneys, and the loss thus incurred is about 8 millions sterling a year. It has been proved beyond dispute that factory furnaces can be quite easily rendered smokeless, and at a saving to their owners of from 10 to 20 per cent of the fuel consumed. With the use of the automatic feeder cheaper coal than anthracite can be adopted. The technical committee of the Coal Smoke Abatement Society has examined and approved grates which, while they maintain the open fire, consume all the carbon, and hence no appreciable quantity of smoke ascends the chimney.

The magnitude of potentiality of the maritime prosperity of Great Britain has been graphically illustrated during the past few months, owing to the state of affairs in China. When England went to war with South Africa, the whole of her 230.000 troops were dispatched from England in their transports without any appreciable interference with her mail services to the various parts of the world. True, some of the larger, more commodious, and fleeter vessels were commandeered to accelerate the passage of the troops to the seat of war, but their places upon the mail services were easily filled by other boats, and the international traffic has been carried on in its usual manner. Indeed, it was difficult to believe that the country was at war, since everything was accomplished so smoothly and without the slightest hitch. But the same cannot be said in connection with the maritime commerce of other nations. The transportation of the troops from Germany to China was such a tax upon the young country that its ordinary maritime traffic was in danger of being absolutely dislocated. The solution of the difficulty was the chartering of English vessels, which were readily obtained. Russia was placed in the same dilemma, and when France was embroiled with Madagascar, the French troops were conveyed to the scene of operations in English vessels. Gigantic though the maritime commerce of Great Britain is, it is still rapidly increasing. At present that country's foreign trade is equal to one-fifth of that of the whole world in value. According to Lloyd's Register of shipping for 1900–01, no less than 7,020 steamers, aggregating 11,513,759 tons, and 1,894 sailing vessels, representing a tonnage of 1,727,687 tons, are owned by various companies throughout Great Britain. Then the various colonies own 910 steamers of 635,331 tons and 1,014 sailing vessels equal to 384,477 tons between them. Therefore, it will be seen that the grand total for Great Britain and her colonies is as follows: 7,930 steamers, aggregating 12,149,090 tons; 2,908 sailing vessels, aggregating 2,112.164 tons; grand total, 10.838 vessels, aggregating 14,261,254 tons. According to Lloyd's, the whole of the world's over-sea traffic, with the exception of the smaller insignificant states, is carried on with 28.422 vessels of all kinds, representing a gross tonnage of 29,043,728 tons. Therefore, it will be seen that Great Britain and her colonies own about one-third of the world's vessels, amounting to nearly half the world's gross tonnage.

### Electrical Notes.

Mr. H. Edmunds, of London, has devised a means of insulating cables with paper. His idea consists of thoroughly impregnating paper with a mixture of resinous material and oxidized oils, which are reduced to a thin consistency by the application of heat. The paper is then immersed in this solution, and allowed to become completely saturated with the mixture. When it is withdrawn from this bath, the permeated paper is wound spirally round the conductor. The inventor claims that the paper when immersed in the resin and oil bath soaks up a sufficiency of the solutions to form a layer between the folds of the paper, between the conductor and the paper, and also outside the paper. These operations are conducted while the paper is still warm and the solution fluid. He then permits the treated conductor to cool. Instead of treating the cable in the above mentioned manner, strips of paper saturated with an oily matter or lubricant which is free from moisture and of good insulating qualities may be wound round the conductor alternately with the resin impregnated paper. The inventor, after he has covered the conductor with this paper, winds round an outer wrapping of braiding or some other material, such as jute or cotton, which has previously been immersed in a hot bath of a mixture such as diatrine.

The most economical light is that whose spectrum is confined to the visible rays, and which does not involve the simultaneous emission of either infra-red or ultra-violet rays. Electric light marks in this respect a distinct advance on the older methods of lighting, and electric luminescence decidedly so. But no form of light hitherto produced equals that of the glow-worm in efficiency. The light of luminous organisms only contains an infinitesimal amount of heat. R. Dubois has been exhibiting some "photo-bacterial" products at the Paris Exhibition, and he now gives some particulars of the liquid medium which best suits their development. The liquid exhibited at the Palais de l'Optique consists of water containing sea salt, glycerine or mannite, and either peptone or asparagine, with an addition of some phosphorated compound like nucleine, phosphorated lecythine, or potassium phosphate. The author gives no information concerning the species of bacteria used. He says that the permanence of the light varies with the purity of the ingredients and the ventilation and agitation of the liquid. It may last six months. A room may be lighted up with a luminosity like that of the full moon. It may be that these photo-bacteria will acquire the industrial importance of the yeast fungus, but that will probably be eclipsed by some purely physical method of generating cold light.—R. Dubois in Comptes Rendus.

Mr. H. Bremer, of Neheim on the Ruhr River, has been conducting some exhaustive experiments with a view to obviating the blue color of the electric arc light. He has prepared some special carbon impregnated with salts of calcium, silicon, and magnesia, especially with calcium, the reddish yellow flame proceeding from which considerably softens the color of the light. The oxide of calcium covers the inside of the globe with a thin coating of a white deposit which serves to diffuse the light in all directions, in the same manner as if a frosted glass globe were employed. By this means the glowing point of the carbon is not seen, neither are there any of those shadow lines upon the upper half of the globe and practically darkness beneath the lamp, but the globe is bright all over. Photometer tests have been taken of lamps supplied with these carbons, and they prove all that the inventor claims for them. With an arc lamp taking 12·3 amperes at 44·5 volts, the light was constant, over 6,000 candle power in the cone between 45° and 90° with the horizontal, and 1,000 candles on the horizontal itself. The electric current consumption of the lamp was 0·196 watt per candle without a globe and 0·196 watt per candle with the globe to yield a hemispherical intensity of 4,300 candles. The inventor places his carbons in a vertical position, but slightly out of alignment. The arc is flattened out so that the light emission may be improved. The inventor states that his carbons are especially valuable in misty weather, owing to the yellow nature of the light. One of these arc lamps with four arcs has been suspended at a height of 312 feet from the Eiffel Tower in the Paris Exposition, so that their various advantages and potentialities may be estimated. The four lamps are arranged in two series, and take together 55·8 amperes at 89·3 volts. Tests were carried out with these lamps at a height of 26 feet above the ground, first without a globe and then when fitted with the globe. In the first instance the light intensity was 80.000 candles, corresponding to a current consumption of 0·1 watt per candle, that is, with the hemispherical intensity estimated at 49,730 candles. But when the globe was fitted, the hemispherical intensity was reduced to about 26,900 candles, which is equal to a current consumption of 0·17 watt per candle. There is one drawback, however, to these carbons, and that is that they are consumed in about half the time it takes the ordinary carbon to burn.

### A MECHANICAL SCARIFIER.

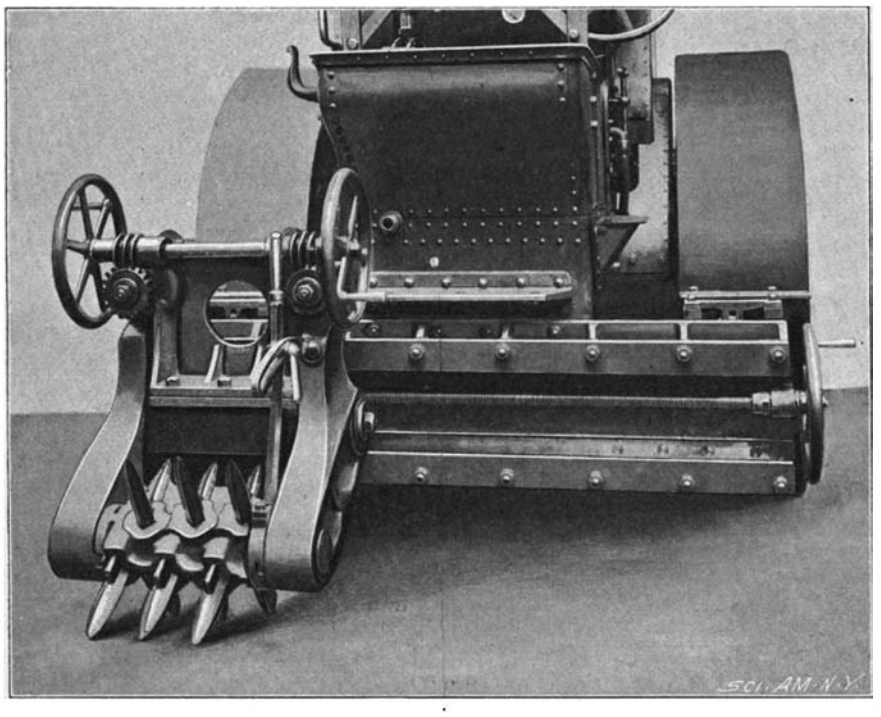
Probably no road paving is worse than a macadam road when it gets uneven and is in want of renovation. But the repair of a macadam road is both slow and expensive, necessitating the blocking of the thoroughfare for several days. Then, again, pedestrians incur considerable risk by flying pieces of stone, which cannot possibly be avoided by the hand-picking process. Messrs. Marshall & Sons, Limited, of Gainsborough, England, have placed on the market a scarifier which may be attached to a traction engine or steam roller. The scarifier is attached to the back end of the tender of the roller in such a manner that the weight and strain in connection with the same are equally distributed over the full width of the tender. The latter is constructed of extra thickness and strength, so that there is no possibility of the roller itself being pulled to pieces through the vibrations of the scarifier.

The scarifier itself works on a traversing motion. By this means it can be set to scarify any part of the road, from the gutter on either side to the crown, without having to turn the engine round. Then, again, it can be arranged to operate either backward or forward, and the depth of the cut into the road can be easily regulated by means of a hand wheel and worm gear. Under ordinary circumstances it will score the road to a depth of about two or three inches, but, of course, this depends upon the nature of the road upon which the scarifier is at work.

The scarifier consists of a dozen chisels mounted in a swinging frame, pivoted at its upper extremity and carrying two segments of worm wheels gearing into two worms. The tools are rigidly held in position in the frame by means of wedges, so that there is no possibility of their working loose while at work. They can easily and readily be withdrawn when required for sharpening or replacement. One set of chisels is intended for forward work and the other set for working backward. A lever actuates in a slotted sector, for the purpose of changing the scarifier from the forward to the backward motion, and vice versa.

When the roller has completed its work, the scarifier may be lifted from the ground to any desired height by means of the hand wheel and worm gear. This arrangement of gear is self-locking in any position.

By working with one of these scarifiers a macadam road may be scored in a very short time, and it performs the work much more thoroughly than the handpick, while there is also a considerable saving of material. The picking of a road is very destructive to the metal, but by means of this scarifier it is simply turned up regularly, and often only requires leveling and rolling in again. Then, again, the surface of the road is disturbed to a uniform depth throughout the whole section, which desideratum it is impossible to obtain by means of the handpick.



A SCARIFIER FOR MACADAM ROADS.

### THE 16-INCH RIFLE AND 20-INCH SMOOTH-BORE COMPARED.

In our recent article on the new army 16-inch gun, we described the construction of this powerful weapon and gave some particulars of its remarkable ballistic powers. It was shown that if the gun were set up at the Battery, New York, with an angle of elevation of forty degrees, and fired with a full charge of smokeless powder, the shell would reach a maximum height of 5¾ miles, and range to a distance of just under 21 miles. With a view to showing what a vast area would be dominated by such a gun, we present the accompanying map of New York city and vicinity, from which our cosmopolitan readers may readily determine whether their nightly ride of one hour, more or less, into the suburbs would be sufficient to place them beyond its zone of fire.

By the courtesy of the War Department, we are enabled to present the accompanying photograph showing a full-sized model of the new 16-inch army gun, suspended above two of the largest coast-defense guns of the civil war period. The one to the left is a 20-inch smooth-bore Rodman, the largest smooth bore in the world. The gun to the right of it, below the chase of the 16-inch gun, is a 300-pounder Parrott rifle, which also is the only one of its size ever constructed, all the other Parrotts being of 8-inch, 6-inch and smaller bores. The 20-inch Rodman closely resembles in outline and relative proportions the celebrated 15-inch smooth-bores, of which so many were used in the civil war. The iron used in casting the gun was what was known as a No. 2 warm blast hematite. The smelted pigs were remelted and cast into pigs, which were again melted in three air furnaces. The weight of the iron melted was 172,000 pounds, time of melting 7¼ hours, time of casting 23 minutes. After the gun was cast, water was run through the core for the first 26 hours, after which air was forced into the bore at the rate of 20 cubic feet per minute from the 11th of February, 1864, the day of casting, to the 24th of the same month. The tenacity of the metal was found by actual test to be 28,737 pounds to the square inch. The length of this gun is 20 feet 3½ inches, the maximum diameter 5 feet 4 inches, the diameter of the muzzle is 2 feet 10 inches, and the total weight 115,200 pounds. For the sake of comparison we recapitulate some figures of the new 16-inch army rifle as follows: The length of the gun is 49 feet 2·9 inches, the maximum diameter at breech 5 feet and at muzzle 2 feet 4 inches, and the weight of the finished gun 300,000 pounds. The weight of the shot for the 20 inch smooth-bore was about 1,000 pounds, whereas the shell for the 16-inch gun will weigh 2,370 pounds.

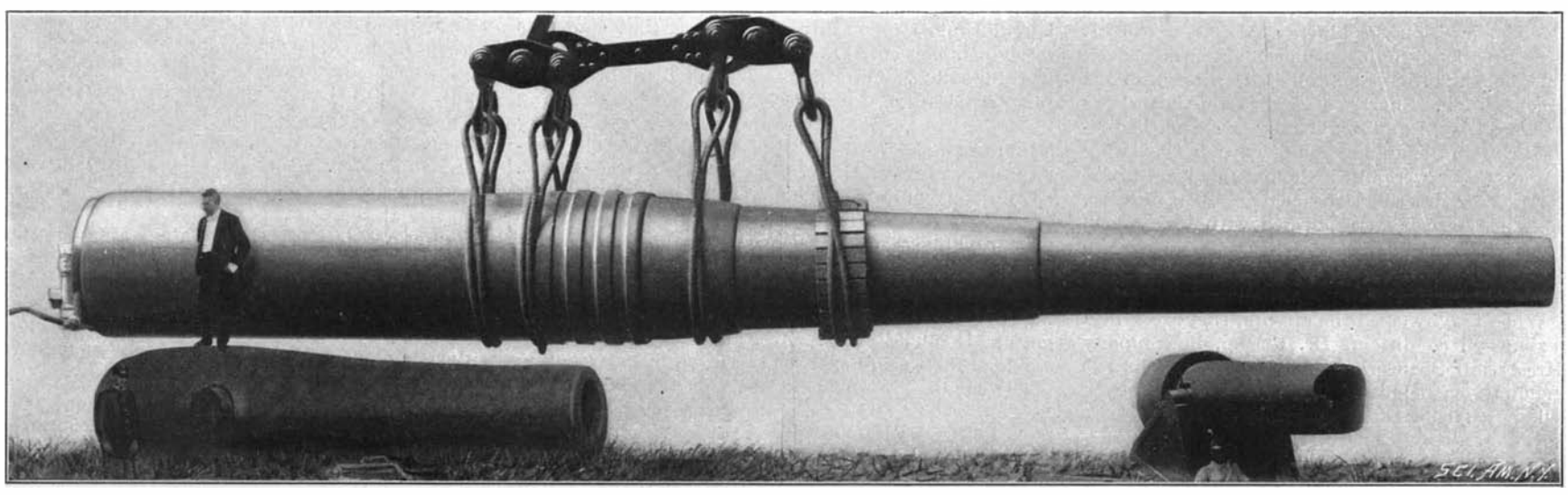
MAP OF NEW YORK AND VICINITY SHOWING AREA DOMINATED BY FIRE OF 16-INCH GUN.

### Phosphorescent Bacteria.

M. Raphael Dubois, in a paper read before the Académie des Sciences, describes a series of experiments in which he obtains a luminous source of considerable intensity by the use of certain microbes or photobacteria, which have the power of emitting light. These are allowed to propagate in a liquid bouillon of special composition. When the experiment is made with good microbe cultures to start with, and at the proper temperature, the development is rapid, and the liquid soon contains the microbes in sufficient quantity to give the luminous effect. A glass vessel is used to contain the liquid, preferably with plain sides, and it is possible in this way to light a room strongly enough to distinguish the features of a person placed at several yards distance, and newspaper type may be read. The light has scarcely any calorific effect, and the properties of its chemical rays seem to be also feeble, as it requires several hours' exposure with an instantaneous plate to obtain a good image; on the other hand, the rays seem to possess considerable penetrating power, as impressions may be made upon the plate even though screens of wood or cardboard are interposed. A sheet of aluminium is, however, not traversed by the rays.

In these experiments it is important that the bouillon in which the microbes are propagated should be well prepared. It should contain water, salt, an aliment analogous to glycerine or mannite, another represented by the peptones or asparagine, and an aliment containing phosphorus, such as nucleine or phosphates, as well as traces of the mineral compounds which enter into the composition of such organisms. The use of peptone is attended with some difficulty, as putrefaction is likely to set in and destroy the action; if it is used, it should be aerated by a current of sterilized air and slightly agitated.

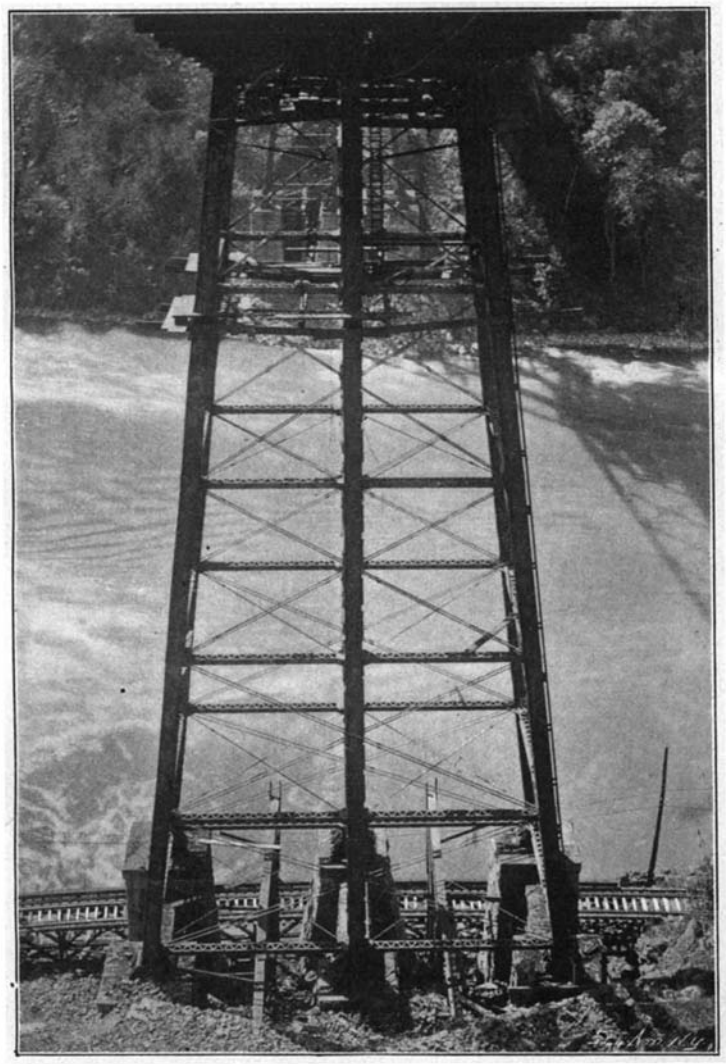
With asparagine the best results have been obtained, and the solution keeps well, giving the phosphorescent effect in free air; its cost, however, is a disadvantage. If well prepared, the phosphorescent solution will keep for a long time without deteriorating; the experimenter has kept some samples in a basement at a low temperature for more than six months. He expects to be able to increase the luminous effect, and thinks that a practical outcome may result from these experiments.



THE NEW ARMY 16-INCH BREECH-LOADING RIFLE COMPARED WITH A 20-INCH RODMAN SMOOTH-BORE AND A PARROTT 300-POUNDER RIFLE.

## STRENGTHENING THE CANTILEVER BRIDGE AT NIAGARA.

Niagara has a world-wide reputation for its famous bridges. More than one notable suspension bridge has been built in wood, remodeled in steel, and then has given way to the more modern steel arch, in order to meet the requirements of present day railroading and road traffic. This work has called for the exercise of unusual engineering skill and some daring originality, and, indeed, it is difficult to find any spot which possesses more interest for the bridge engineer than the Niagara Gorge.



ONE OF THE TOWERS, SHOWING THE CENTER STRENGTHENING COLUMNS.

The accompanying photographs draw attention to the latest difficult feat to be accomplished in this locality. They show the work of strengthening the steel cantilever bridge of the Michigan Central Railroad, which, completed in 1883, finds itself quite unequal to the traffic demands of the year 1900.

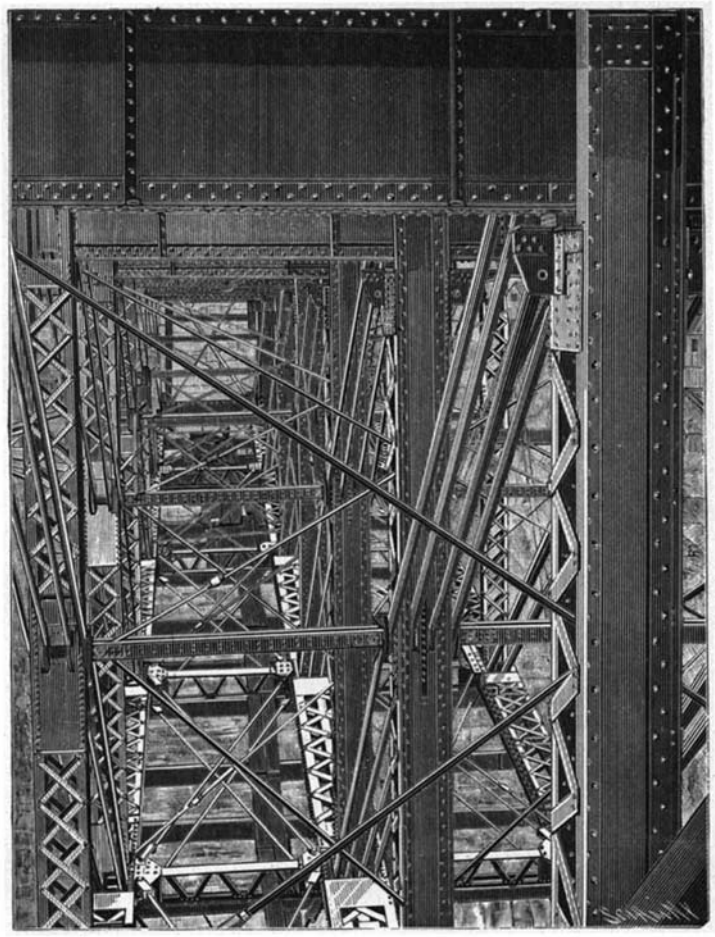
This bridge, which is 910 feet long, and consists of two cantilevers and a fixed span in the center, the "cants" resting on towers 130 feet high, was originally designed to carry on each track a train consisting of two 65-ton locomotives followed by a train load of 2,000 pounds per lineal foot. When the improvements have been completed, the bridge will support two trains of over 3,000 pounds weight per lineal foot, headed by two 150-ton locomotives.

The work that is now being done is the insertion of a center truss, and this is accomplished by cutting the great structure in two longitudinally through the center and building the new steel work into place. The new truss is three times heavier than either of the old trusses, and the work will increase the carrying capacity of the bridge by from 75 to 100 per cent. The reconstruction has been in progress since last winter, and is being done by men employed by the Michigan Central. Between the old piers at the water's edge two new stone piers have been erected on each side of the river, and each of these piers supports one of the new columns. On top of these new piers iron shoes weighing 10 tons each have been placed. These shoes are heavier by four tons than the shoes on the old piers. Reaching up from the shoes to the bottom chord of the bridge are columns of steel, which were placed in 25-foot sections, and weigh 12 tons to a section.

When the new columns had been carried up to their full height and riveted in place, they were capped by two massive 7-ton castings, whose duty it is to transmit the loads of the new truss to the new tower. Between these castings was placed the section of the bottom chord of the new truss that extends over the tower, and above them were placed the vertical posts 55 feet long that extend between the bottom and top chords. On the top of these posts were placed other steel castings. In these castings in top and bottom chords are assembled the various eye-bars, posts, struts, etc., that cluster at these points, each series being connected by large, turned, and snugly-fitting pins. The center truss was then built out over the river, the various posts, ties, etc., being lowered into place from the floor of the bridge by means of a temporary "traveler," which was shifted from time to time as the work progressed.

With the addition of so much dead and live load to the bridge it was, of course, necessary to increase the anchorages. The old anchorages were about 26 feet long, and extended down to the bottom of the shore abutments. The new anchorages are 40 feet long, and extend down into the solid rock 16 feet. The addition was made by opening the abutments and blasting out the rock to the required depth. At the bottom of the hole so formed, cupboards about 7 feet wide and 12 feet long were opened, and in them I-beams seven in number were placed. Each of the I-beams weighs 900 pounds. The holes are to be filled in with concrete.

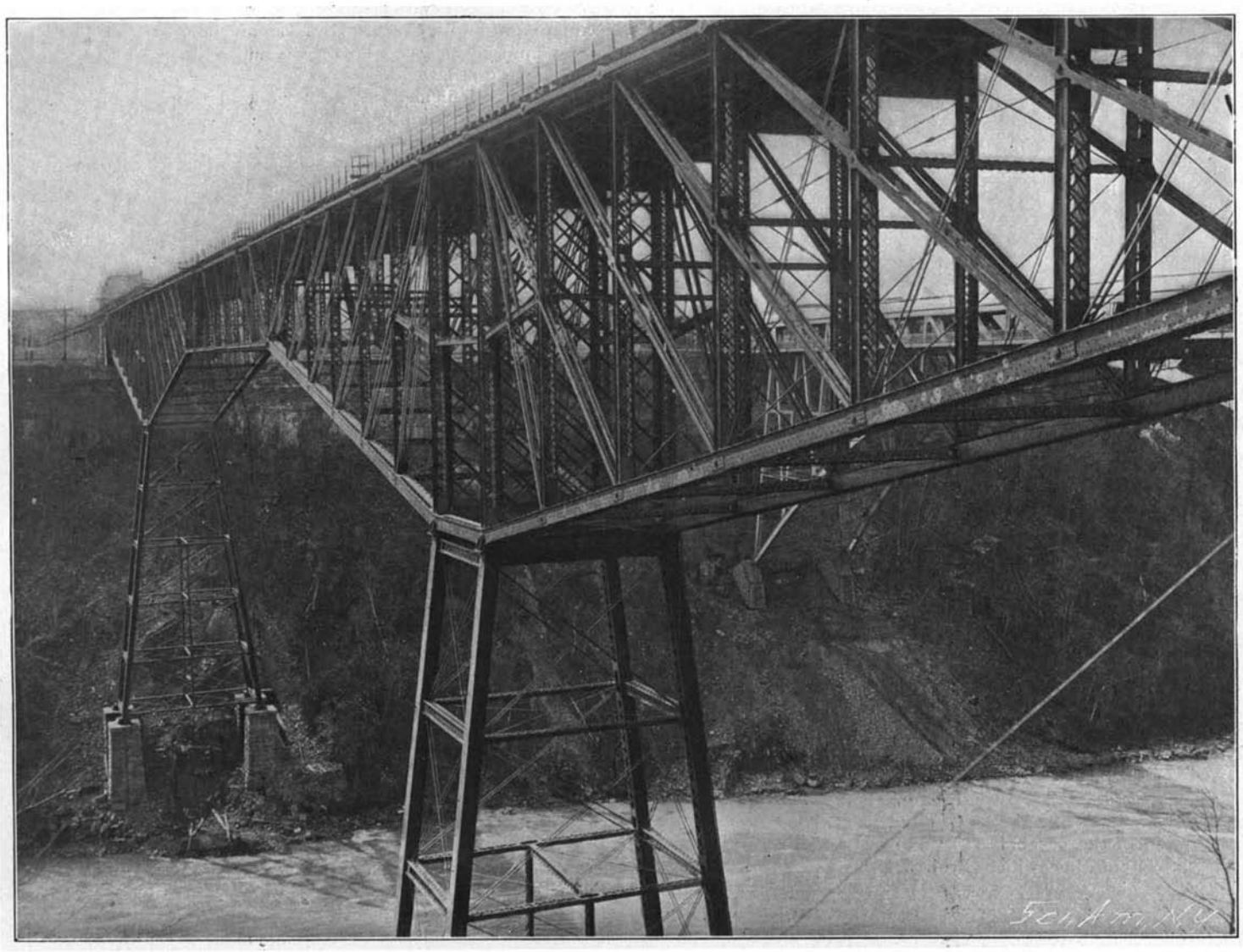
The old laterals were about 30 feet long and extended diagonally from one post to another. In the reconstructed bridge they will extend from the outside posts to the posts of the center truss. In rebuilding the bridge it was found necessary to cut 2 feet 2 inches out of the floor beams over the tower, temporary timber supports being inserted to support the severed parts of the floor beams. These timber supports rested upon the outer chords. In all about 1,700 tons of new steel have been placed in the bridge.



VIEW LOOKING THROUGH CANTILEVER, SHOWING NEW CENTER TRUSS.

The work of rebuilding the cantilever has gone on undmindful of the traffic across it, which has suffered but little interruption or delay. A traveling derrick 28 feet long, 28 feet wide in the clear, 21 feet clear of track and 30 feet high, has been used. To lower the castings required 3,600 feet of manila line 1½ inches thick, with 10-ton blocks on the traveler. The cantilever is a double-track bridge, and in order to lower the iron it was necessary to cut the ties between the tracks, giving an opening 6 feet wide by 11 feet long. Some of the iron lowered was 50 feet in length. Material was carried out on the structure from both sides of the river.

When the cantilever bridge was erected, all riveting and drilling was done by hand, but in rebuilding the structure modern appliances were brought into service, and riveting, chipping and drilling were done



NIAGARA CANTILEVER BRIDGE BEFORE INSERTION OF NEW CENTER TRUSS AND TOWER COLUMNS.

by compressed air, which was supplied by a plant located on the New York side. In the compressing station there are two gasoline engines, one of 24 horse power, the other of 12 horse power. A 2-inch pipe leads from the storage tanks clear across the bridge, and from this main, connection is made by hose to the points of operation.

Benjamin Douglass, bridge engineer of the Michigan Central, designed the new work, and it was carried on under the supervision of his office, with G. C. Tuthill as the assistant engineer on the work, and David Coughlin as superintendent of erection. The work will be completed during the fall of the present year.

### Transportation Exhibits at Paris.

Much space has been devoted to the transportation exhibits at Paris; an international station is established at Vincennes, covering an area of about 21,500 square meters. The station is a series of halls (says The Railroad Review) about 200 meters long and 120 meters wide. There are shown about sixty locomotives, most of them being large machines, and also more than 200 cars of various kinds. The United States is there "with its remarkable wagons, its practical and comfortable luxury, and with six examples of its colossal and renowned locomotives." Austria with seven engines, Germany with six locomotives and with splendid coaches. Russia, which shows five carriages, attracts attention by the magnificence of the material and the finish of the construction, giving evidence of its great industrial progress. Switzerland shows, among other engines, an electric locomotive for working rack railroads. The French locomotives are seventeen in number. Around the international station are installed signals and various apparatus for protecting trains used by the great French companies and by foreign roads. A German establishment is in operation injecting ties for preservation, and near by one may see a section of the Barmen-Elberfeld suspended electric tramway and a section 50 meters long of a Temperly transporter. Here may also be seen brakes, couplers, axles, wheels, switches, crossings, etc. According to the Journal des Transports, of Paris, the Exposition is a triumph of the compound locomotive and the American car. The long car with bogie trucks, so much criticised among us for twenty years, is no longer a novelty, and now the time of experiment is past. All of the great French companies now use long cars with bogie trucks and corridors for inter-communication. The colossal machine shown in the Russian section seems to be only a Mallet compound locomotive, with two trucks and four cylinders. Germany shows a triple-expansion engine, in which the problem of condensation is courageously attacked. Finally, the electric locomotive is in force. The Paris, Lyons and Mediterranean Railway shows its storage battery engine, and the Orleans Railway its Thomson-Houston trolley locomotive. This latter company makes the most impressive electrical exhibit by the mere fact of putting in operation its city line, underground and worked by electricity.

### The Age of the Earth.

We commence our history with a rapidly-rotating molten planet, not impossibly already solidified about the center and surrounded by an atmosphere of great depth, the larger part of which was contributed by the water of our present oceans, then existing in a state of gas. At what period did these great cosmical changes occur? The answer to this question has long occupied the attention of geologists, and the opinions of the greatest lights of modern science are at variance. At the Bradford meeting of the British Association for the Advancement of Science, Prof. W. J. Sollas, one of the greatest geologists of the century, made a most important address, dealing with the age of the earth. He first gives his attention to the estimates of others, Lyell, Kelvin, George Darwin, Joly and others, and then develops his subject with particular relation to the depth of those rock formations which are clearly of sedimentary origin. He takes them at their greatest thickness, which he finds to be about fifty miles. Naturally, great difficulty is experienced in obtaining even an approximately accurate average rate of deposition, but Prof. Sollas adopts one foot a century as the most satisfactory standard, and on this basis would place the age of the earth approximately at about 26,000,000 years. His arguments tend to harmonize the estimates of others, as far as possible, and he more nearly approaches those of Lord Kelvin than those of other scientists. The estimates suggested by other data are as follows:

1. The time which has elapsed since the separation of the earth and moon, 56,000,000 years. This is the minimum estimate of Prof. G. H. Darwin.

2. Since the "consistentior status" of Lord Kelvin, 20,000,000 to 40,000,000 years.

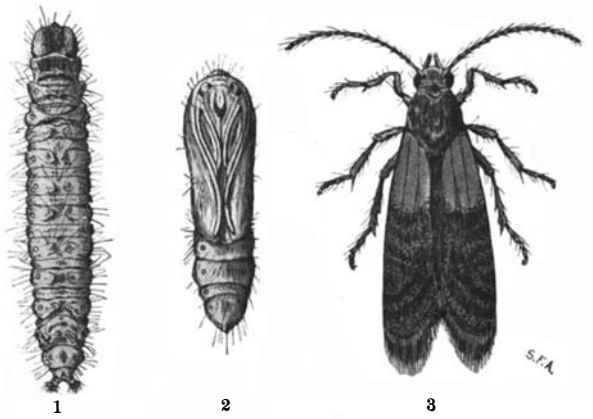
3. Since the condensation of the ocean, 80,000,000 to 90,000,000 years, the maximum time which Prof. J. Joly considers to have elapsed.

It may be at once observed that these estimates, although independent, are all of the same order of magnitude, and so far confirmatory of each other. Prof. Sollas's arguments are most interesting, and his complete address will be published in the SUPPLEMENT, beginning with the current week.

### THE PANTRY MOTH.

BY S. FRANK AARON.

This insect, which has also been called the Indian meal moth, and is known to naturalists as Plodia interpunctella, is, next to the cockroach, perhaps the most troublesome pest of the housekeeper. It is a small insect allied to the clothes moth and the grain moth, and not unlike them in appearance. The pantry moth, however, is more showy in appearance and is bicolored, the outer half of the wings and parts of the body being of a chocolate brown, the rest buff or drab. It is about three-eighths of an inch long when the wings are folded or at rest. The larva is pale, varying from pinkish to gray blue, the tint being influenced by the character of its food. The eggs hatch in a few days after being deposited here and there upon suitable food by the female moth.



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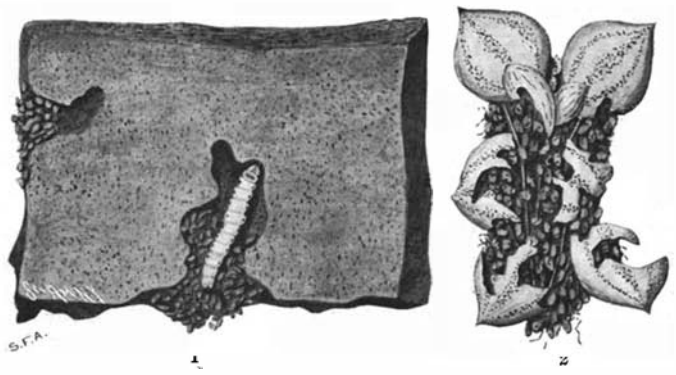
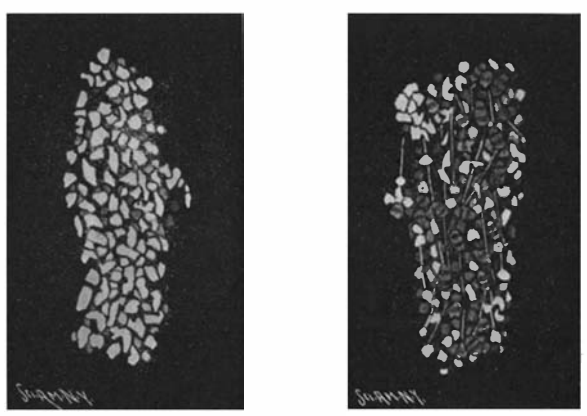
THE PANTRY MOTH AND ITS STAGES.
1. Caterpillar. 2. Chrysalis. 3. Moth. (Magnified.)

Nearly everything edible or nourishing serves for food to this insect, but the materials that it commonly infests are flour, corn meal, grain of all kinds, beans, seeds, dried fruits and vegetables, and chocolate. It is not the quantity the larva eats, however, that makes its presence objectionable, so much as the defilement it causes. Wherever it goes it leaves a silken strand behind it, adhering to its excrement and to the particles of food left uneaten, thus rendering the material utterly unfit for human use.



INJURY BY PANTRY MOTH.
1. Cake of chocolate, showing larva at work (natural size). 2. Millet seed after infestation (magnified).

When full grown, the caterpillar spins a flimsy cocoon, within which the pale yellowish or brown pupa rests but a few days in warm weather before emerging as a moth. If, however, the surrounding temperature should be cold, the pupa may remain in the cocoon all winter. The entire period covering all the stages, egg, larva, pupa and moth, averages, during warm weather, about six weeks, and in artificially heated buildings that cool at night during winter, two or three months. There are, then, about three broods normally during the summer, and in well warmed buildings during winter about two broods, perhaps three. Thus, we have from three to six broods annually, and in very warm climates as many as seven or eight may appear.



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FLOUR INFESTED BY PANTRY MOTH. (MAGNIFIED.)
1. Normal condition. 2. Webs and excrement after being infested.

The pantry moth is practically cosmopolitan, judging from the infested food stuffs received from nearly all parts of the world. There are isolated sections where it does not occur, but in these days of vast commercial intercourse a pest having these food habits is certain soon to be carried everywhere. Only the greatest care, most thorough inspection and fumigation can prevent this result, if at all.

To insure against the presence of this moth, the housekeeper or dealer must resort to storing his food stuffs in insect-proof receptacles. With materials that must have air, a box with wire netting covering the openings for ventilation will suffice, but these openings should be at the side of the box, as it is probable that the moths would drop their eggs through the wire mesh if placed on the top. If material is already infested and only slightly injured, the only way to kill the insects within it is to fumigate with carbon bisulphide, an inexpensive disinfectant. A wad of cotton as large as a lemon of average size, and saturated with the bisulphide, placed in the top of a large can, tight box or keg holding two or three gallons, care being taken to replace the cover quickly and tightly, will destroy all insects and vermin infesting the material previously placed therein. The vapor of carbon bisulphide is heavier than air and sinks to the bottom of a vessel containing it. It is extremely poisonous, and so inflammable that on no account must flame be allowed to approach it.

To insure successful fumigation, the receptacle must remain tightly closed for at least six hours. It can then be uncovered and turned upside down for a few minutes, after which the pungent odor can no longer be perceived. Another way to kill the larva of the pantry moth and similar pests in food stuffs is to subject them to a perfectly dry heat for at least one hour at a low even temperature.

### Automobile News.

There are at present thirteen incorporated automobile clubs in the United States.

Experiments have been conducted in New York with electric vehicles for collecting mail from street boxes. It was found that fifteen minutes were saved per trip.

At the Paris Exposition a dinner was given to over twenty thousand mayors of French cities and villages. This is probably the largest number of persons who were ever served at one time. The tables, if placed end to end, would have been four miles long. Several motor cars and four motor cycles were used to increase the rapidity of service.

A new electric automobile has been brought out by the National Carriage Syndicate, of London. It is of elegant design, each of the wheels being 36 inches in diameter and the distance between axles 67 inches. The force is furnished by two small motors, which operate the rear wheels by a chain which passes from a pinion on the axis of the motor to a large wheel placed on the inside next the spokes. The motor is mounted upon an independent frame, which is supported upon springs. Two sets of accumulators are used, which are contained in two boxes placed under the front and rear seats. Each of the motors gives 2 horse power, working upon 40 volts; it gives 600 to 700 revolutions per minute. The motor is very light, weighing only 105 pounds; besides, it can, if necessary, be worked up to 3 horse power, and runs without noise. The motors differ from the usual type, as the armatures are at the exterior and revolve around the field. The winding of the armature is very simple, and is arranged so as to give a motor of small weight and high efficiency; it may be overloaded as high as 100 per cent without danger. The armature, being of large diameter, acts as a fly-wheel and regularizes the speed. The fields have twelve poles arranged in a circular crown on the inside of the armature. The motors are entirely inclosed and protected from dust. The battery used is of the Rosenthal type; it has forty cells in all, which gives a total weight of 950 pounds. They will give a discharge of 20 amperes for seven hours, and will also stand a considerably higher rate, giving 40 amperes if necessary. The controller is arranged for five speeds, 3, 6, 8, 10, and 12 miles per hour, with a reversing speed of 3 miles. The controller handle is pushed to the front and rear for forward and back movement; it is arranged to give the proper connections for charging the batteries. As the field is separately excited, the motors themselves serve as brakes by the reverse action of the armature upon the field, the motor tending to run as a dynamo. This machine will cover a distance of fifty miles at a single charge.

THE Commissioner of Immigration has decided that tuberculosis is a disease which can subject the patient to quarantine. A Japanese with tuberculosis arrived at San Francisco and it was decided that the patient could not land and must return to the port from which he sailed.

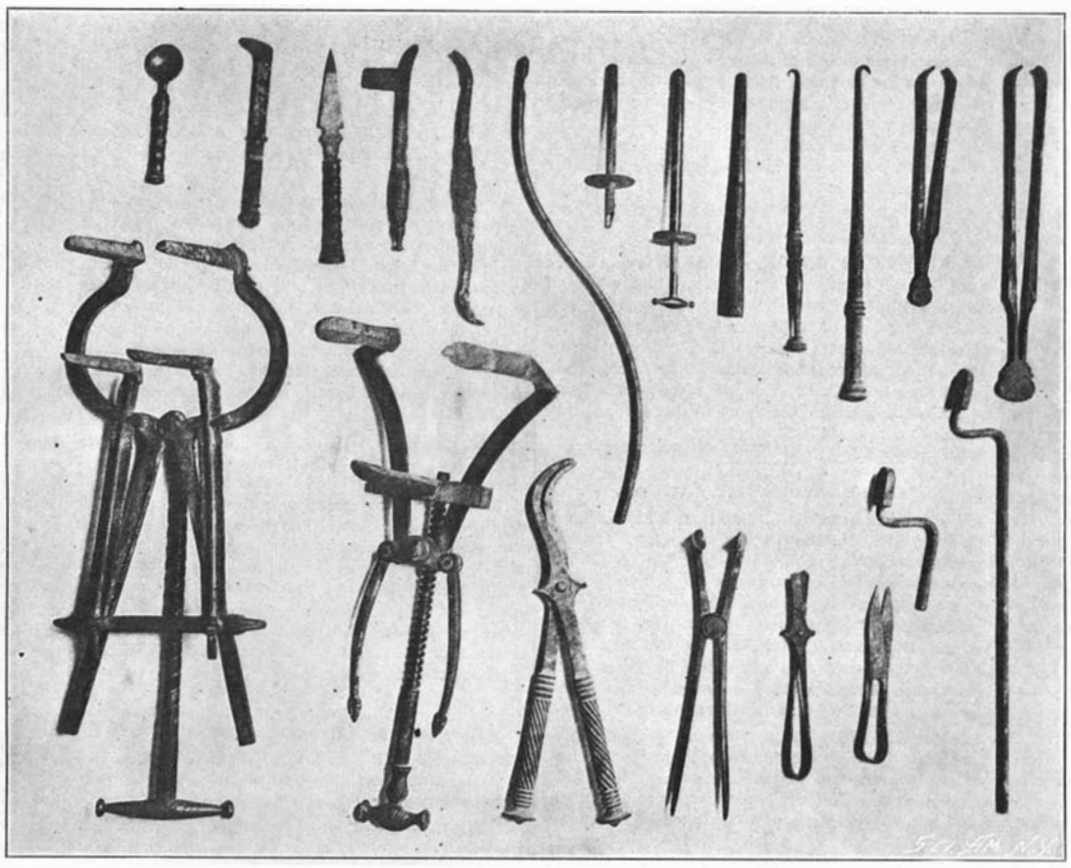
## RE-INVENTION IN THE WORLD OF SURGERY.

BY R. E. THOMAS.

"Died of internal trouble" was the verdict which, prior to the last half century, was the comprehensive term used to record the unsuccessful efforts of treatment of women's diseases. Up to that time gynecology, which has since revolutionized the surgical world, was practically unknown. The few rare cases in which an operation was performed were attended with such an alarming element of danger prior to that time, that even the foremost surgeons hesitated to resort to this last desperate measure. That gynecology was a lost art was an important fact unguessed at since the burning of the great library of Alexandria destroyed an incalculable amount of valuable matter upon this subject as well as of others of equally important bearing in the scientific world. There was, therefore, no scantiest record that such a science had not only flourished, but been brought to its present state of perfection more than two thousand years ago.

Yet such is the case, such the almost incomprehensible truth borne in upon the world of science when the excavations of Pompeii revealed the astounding collection of surgical instruments, mainly for use in gynecology, unearthed in the house of the surgeon adjoining the Temple of the Vestal Virgins.

These instruments, shown in the accompanying picture, now occupy one of the most interesting cases in the museum of Naples, where, for greater safety, the most valuable of the excavation finds are kept by the Italian government. What is far more incomprehensible than the mere fact that these instruments, after having been buried since the eruption of Vesuvius, 79 A. D., have revealed that gynecology was a science flourishing in its perfection long before that date, is that in every instance the instruments are almost in their minutest particulars, exact duplicates of those in use by the most approved modern science of to-day. Had there been a record upon which surgeons and physicians could have built up this practical treatise upon the diseases of women, the wonder would be less. As it is, with absolutely nothing to hint that gynecology was a lost art, or that it had existed even, it seems nothing short of marvelous that modern minds should in the evolution of this century's instruments have traveled along identical lines pursued by those marvelously skilled Pompeiian physicians to the Vestal Virgins ministering in the Temple, on the idyllic remnants of which the sun shines to-day from bluest of Italian skies, and the waters of the Bay of Naples lap their cerulean waves almost to the gateways of that charmed place about which must ever linger so much of romance and poetry.



RE-INVENTION IN THE WORLD OF SURGERY—A GROUP OF INSTRUMENTS DISCOVERED IN POMPEII.

A difference between the surgical instruments of to-day and those of the ages ago is that while the latter were of the finest wrought iron, those of the former are of polished nickelplate. But the workmanship is as fine as anything to be produced in this line in the twentieth century. The instruments are hand wrought, the screws as threadlike and capable of as delicate manipulation as anything to be found in to-day's achievements.

It is not more than half a century since gynecology may be said to have had a place in modern surgical science. Dr. Marion Sims in the lead with his duckbill speculum has had a mighty rush of followers. Dr. Sims' treatment of vesico-vaginal fistula was a revelation at the time. To him the world is indebted for the suggestion and perfection of measures by which this almost untreatable condition has been rendered one of the most certain of relief within the field of surgery. From profound ignorance his duckbill speculum has brought gynecology to the front ranks of surgical skill and attainment.

In every particular, however, Dr. Sims had been anticipated, as in May, 1829, Dr. H. S. Levert in The American Journal of Science expounded the results of his experiments in the use of silver wire. This was followed on November 21, 1834, in The London Lancet, by Mr. M. Gosset giving a description of his method of using silver wire, and later in 1846 was published the method of Metgler.

The first record which surgical science has in this country of the use of a speculum was of an ordinary teaspoon used by a Southern country practician to enable him to see a rent in the bladder of a woman patient. By this primitive means he was subsequently enabled to administer successful scientific treatment.

Following Dr. Sims' trip abroad, when the value of his invention was recognized by the leading surgical authorities of England and France, he returned to this country to make a large fortune by this means. The speculum was then taken up and developed, and additional discoveries practically put to use by other eminent surgeons and physicians, each in turn giving to the instrument his own name. Among the best known of these are those of Meier, Cusco and Ferguson.

Following upon these inventions, together with others of similar nature, came those finds in the Pompeiian excavations of the house of the surgeon which told to the world a stupendous truth, that the instruments in use to-day, for the alleviation and cure of internal troubles, are identical with those used by skilled practitioners when the world was younger by two thousand years.

### Bat Guano Caves in Southern New Mexico.

Southern New Mexico is a land of natural curiosities, and one at least of these has proved to have a high commercial value. A resident of that district had the good fortune a few years ago to accidentally stumble upon several bat caves, one of which is stated to be some six miles in length, and as he has shipped in the last two years 3,392,240 pounds of phosphate or guano from these caves, for which he has received about $48 per ton, it can be understood that the present and prospective value of these caves is considerable. It can be readily understood that bat guano possesses great value as a fertilizer, and the value of the caves is enhanced by the fact that beneath the guano is a considerable deposit of phosphatic rock (the remains of defunct bats), which, when ground up and treated with phosphoric acid, is highly prized as a fertilizer.

Since the discovery of these ancestral homes of the bats, in which they have made their resting place for unnumbered centuries, the search for more such caves has continued intermittently, and it is probable that many more valuable finds of this nature will be made; for the section of the country in which they lie is literally infested with this obnoxious, but very lucrative, little creature. The caves which are frequented by bats are of lava formation, and carry evidence of having been subject to violent volcanic action. A remarkable bat-trait is mentioned by our correspondent, which has the effect of rendering the caves of permanent value. It seems that after the entire front of the first of these caves to be opened had been torn down to within a foot or so of the narrow openings through which for centuries the bats have come and gone, the little creatures continued, and still continue, to follow the ways of their ancestors. Flying upward past the large openings, they would squeeze in and out of the caves as of old. Since the first cleaning out of one cave seven tons of guano have been removed, all of which had been deposited subsequently to the first removal. It is estimated that from the deposits which have already been discovered, there has been taken an annual crop of about 1,500 tons of guano.

### Remodeling the Victorian Patent Practice.

There is a movement afoot in the colony of Victoria, Australia, which has for its object the carrying out of certain drastic reforms in the patent laws, and the reorganization of the staff and office of the department of patents in the interests of inventors. This movement has taken the form of a petition addressed to the Victorian legislative assembly, which is being extensively signed by leading men of all trades and professions in that colony. The petition has been initiated by a leading patent agent in Melbourne, and it is receiving considerable support from those members of the profession who consider that a more liberal treatment of inventors will ultimately lead to more extensive business in patents.

In reading the petition it is evident that the mainspring of the movement is to be found in the more liberal and advanced methods which are in vogue in our own patent system, and in a less degree in that of Great Britain. The most important point asked for in the petition is that the examination into novelty may be retained. It is claimed that this examination, which was prescribed by the patent act of 1890, is now conducted by the department with sufficient completeness to be of great public benefit, and that it is, in a large degree, a deterrent of fraudulent and improper applications. It is claimed that the abolition of examination into novelty will throw the burden of search upon the inventor, and that if the examination is struck out, the patentee will be under increased expense of from $75 to $150 for an ordinary search, while it would be no uncommon thing for a heavy examination to cost $250. The petition quotes the report of the Commissioner of Patents of the United States as affirming that it is because of novelty examinations that patents are so salable in this country. The petitioners are of the opinion that "to avoid grievous restraints of trade, encouragement of impostures upon the public, the undue raising of prices of commodities, and the unnecessary multiplication of ruinous lawsuits, the granting of illegal monopolies upon articles of commerce without any investigation as to the novelty of such articles should not be permitted."

The petitioners also pray that the Patent Office examiners' reports, as well as other documents in connection with patent monopolies granted, should be open to public inspection in like manner as in the United States of America. It is also requested that steps be taken to remedy the long-continued and grievous delay and shortcomings in respect to the issue of publications from the Patent Office respecting new inventions and monopolies; and the reasonableness of this petition will be understood when it is learned that the publication known as "Patents and Patentees," issued by the Victorian Patent Office, is nine years in arrears, and that after being printed it can only be obtained at a cost which is prohibitive to the majority of inventors interested in securing it. It is certain that in the judgment of American inventors, the authors of this petition are making out a very strong case for reform.

### The Current Supplement.

The current SUPPLEMENT, No. 1294, has many interesting addresses and lectures. "Chemical and Technical Education in the United States," by Prof. C. F. Chandler. This is a most important paper, and deals with the subject in a masterly manner. "The Age of the Earth," by Prof. W. J. Sollas, is an address before the British Association. "Australia: The Wonderful Island Continent" is a thoroughly illustrated article by Sidney Dickinson, F.R.G.S. The Opening Astronomical Address, by Dr. A. A. Common before the British Association, is concluded in this issue. "American Sun Myths" is an address by Dr. Franz Boas.

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(Illustrated articles are marked with an asterisk.)


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## RECENTLY PATENTED INVENTIONS.

### Agricultural Implements.

PLOW.—JOHN W. REAVES, Morgan, Ark. The invention provides a simple and effective means whereby cultivator blades or teeth may be arranged at one or both sides of a "bull-tongue" plow-blade or adapted for use in connection with the share of a turning-plow. The device is characterized by its simplicity and effectiveness.

### Mechanical Devices.

WATER-WHEEL.—MARK A. BROWN, Douglas, Ga. The water-wheel is of the type in which the water operates upon a series of blades or buckets. On the bottom of a casing the motor-wheel is mounted to revolve. A shaft is held to rotate with the wheel, but is free to slide relatively thereto, and is provided at its lower end with a ball bearing below the bottom of the casing. Owing to the sliding connection of the wheel with the shaft, the weight of the machinery connected with the other end of the shaft is supported by the balls and the bearing. The operation of the wheel is not affected by axial vibration.

COMBINATION-TOOL. — FREDERICK C. ENGELHARDT, Manhattan, New York city. The tool is to be used by machinists for repairing articles of metal or wood. In standards supported by a base, a lathe-spindle is mounted. On its inner end the lathe-spindle carries a lathe-chuck. A holder, mounted to slide on the base, is provided with a box-receptacle constituting a socket to receive dies for cutting bolt threads. The box-receptacle has vertical grooves in its side walls, extends out through the bottom, and has horizontal grooves in the walls at the bottom, intersecting the vertical grooves. Set-screws in the side walls of the box-receptacle hold material in place.

PICKER MECHANISM FOR LOOMS. — EPHRAIM M. KEFFER, Hespeler, Ontario, Canada. By means of this invention the picker-stick and connected parts are prevented from being broken in case the picker-stick is accidentally locked against movement by the shuttle's lodging on the top of the picker, thereby preventing the picker-stick from actuating the picker and throwing the shuttle through the open shed.

CAN-LABELING MACHINE. — WILLIAM H. LEISTER, Westminster, Md. The cans are rolled along a chute or track and are successively operated upon. A portion of the adhesive material is appplied to the can; and the can is then rolled upon a pile of labels, picking off the upper label by means of the adhesive material and then wrapping the label about the can, the other end of the label being pasted so that, as it is wrapped about the can, it will be secured in place. The novel features of the invention are an improved means of feeding the cans to the chute by means of receiving-tracks; a device which enables cans of different sizes to be labeled; a mechanism for regulating the rate at which the cans are fed; a device for applying a small quantity of paste to the can; a label-feeding mechanism; and a seaming appliance.

HOISTING-GRIP.—JOHN PIERCY, Brooklyn, New York city. The hoisting-grip comprises a casing in which gripping-jaws are arranged and mounted to move toward or from each other in order to grip or release the cable. The jaws are provided near their upper ends with outwardly-extending ears or lugs formed with elongated slots. Pins or bolts extend through the slots. In the casing cam-levers are pivoted, the cam ends of which are adapted to move into or out of engagement with the jaws to grip the cable or rope. Links pivoted to the outer ends of the levers are connected with a hoisting device. Upon an upward pull, the links cause the levers to move the jaws into gripping contact with the hoisting rope or cable. The device is simple and durable in construction.

GRINDING-MACHINE. — FRED A. NYSTROM, Cosmopolis, Wash. The invention is designed to grind the faces of band-saw wheels and to render these faces true to insure proper running of the band. The machine comprises two oppositely-extending swinging frames, in one of which a grinding-wheel is mounted and in the other of which a pulley is held. Between the grinding-wheel and the pulley, gearing is arranged, whereby the former is operated from the latter. An adjusting device for the frame carrying the grinding-wheel is provided.

CLIP-FORMING MACHINE.—GEORGE E. SOPER, Kankakee, Ill. The invention relates to improvements in machines for forming or bending metal into U-shape to form clips while the metal is cold, thus saving the expense of heating and the extra work of handling hot metal. Manufacturers find it necessary to heat the stock before bending, so that when formed, the opposite members of the clip will remain parallel when cold; for, in the ordinary method of cold bending, the ends of the members spring out of parallelism. According to the present invention, the metal strip is so bent that, when finished, the side members of the clip will be spaced apart equally throughout their length.

FRICTION-BRAKE. — FRIEND N. and HARRY W. WHITCOMB, Barre, Vt. This friction-brake is designed for use on power capstans and other machinery. The mechanism comprises a brake-wheel; a split brake-ring having one end forked and carrying brake-blocks on its outer face to engage the brake-wheel; and a shaft mounted in the forked end of the ring. An eccentric is secured to the shaft between the members of the fork of the ring, with its working face projecting beyond the end of the ring. The drum can be readily braked by turning the shaft to open or close the ring and move the blocks into or out of engagement with the brake-wheel.

DEVICE FOR EMPTYING TANNING-LEACHES. —BENJAMIN SYKES, Curwensville, Penn. The combined agitating and collecting device consists of a series of arms which radiate from a hub and which closely approach the inner face of the leach. Each stirrer-arm is provided with collecting-blades, the shanks of which are adjustably bolted to the stirrer-arms. These collecting-blades serve to plow the tan from the center of the leach and direct it to the sides, so that by means of the stirrer-arms it can be pushed to a discharge-opening.

### Dental Inventions.

DENTISTRY. — AUGUST P. JOHNSON, Ada, Minn. The invention is an improvement in the construction and attachment of pivot-teeth. The crown or artificial tooth has a symmetrical conoidal cavity. A post or anchor is baked in the crown and fixed in the center of the cavity. A convex, metal cap, made separately or independently of the crown and post, has a central opening adapted to receive the post and allow adjustment therein. The cap fits the cavity, whatever may be the adjustment of the crown. The crown can be set at an angle to the root, instead of in alinement with it, without affecting the accuracy of the fit. The crown has all the merits of the well-known Richmond crown with none of its defects.

DENTIST'S STOOL.—GEORGE B. MCKINNEY, Barry, Ill. This improved stool is so constructed that it will have a yielding or spring action laterally in any direction, the spring-section permitting this action being a portion of the standard or upright of the stool. The seat of the stool can be conveniently raised, lowered, and held firmly in adjusted position.

### Vehicles and Their Accessories.

TRACE-LOCK.—THOMAS J. HALSTEAD, Dallas, Tex. The trace-lock consists of a ferrule adapted for attachment to a whiffletree, and a button carried by the ferrule, which button can be placed and held in either a horizontal or a vertical position and be operated by one hand as readily in the dark as in the light.

THILL-COUPLING. — WINSTON K. PENDLETON, Ocoee, Fla. The object of the invention is to provide a thill-coupling of comparatively few parts, easily detached from and attached to the axle, and with which the shaft or pole can be coupled quickly and securely. The pole is held by jaws having recesses at their upper ends. A base-plate extends beneath the axle, is connected with the jaws, and has an aperture near its rear end. A bolt extends loosely through the aperture near its rear end. A clip engages the bolt and extends over the axle. Ears on the clip are arranged to enter the recesses in the jaws. The shaft or pole is securely held from withdrawal.

HANDLE-BAR. — ALEXANDER BIES, Schenectady, N. Y. This bicycle handle-bar comprises the usual stem to which a head is secured having tubular ends in which fluted pins are inserted. The gripping-bars have their tubular ends interiorly fluted and arranged to fit over the tubular pins and into the tubular ends of the head. The gripping-bars can be readily raised or lowered and moved nearer together or further apart to suit the convenience of the rider.

### Railway-Appliances.

RAILWAY-CAR CHOCK. — JOHN T. CONDON, Le Mars, Iowa. When cars are switched to a siding, it sometimes happens that, by reason of too great momentum or failure of the brakes, they will pass off the siding and on the main track again. The invention provides a simple device for preventing the cars from passing off the side track. The device consists of a lever-controlled, hook-shaped beak which can be lapped over the track to obstruct the car-wheels.

### Miscellaneous Inventions.

FURNACE.—JOHN S. L. RODRICK, 101 Fifth Street, Washington, N. W., District of Columbia. A series of upright superheating-chambers encircle the fire-pot and combustion-chamber and discharge at their upper ends into pipes or supplemental flues which lead into the main heating-flues. By this construction a large number of superheating-chambers is provided, the heat from which flues may be directed into any desired one of the main heating-flues to increase the heat supplied to the main flue and to induce the heat up through the flue.

REFRIGERATOR.—CARL SANDER, Brooklyn, New York city. In this construction a door, when opened, will occupy a position in the compartment out of the way and will automatically cause a sliding support for material in the compartment to be carried out of the refrigerator so that the material is readily accessible. When the door is closed, the sliding support re-enters the refrigerator.

COTTON-VALVE.—GEORGE W. WILLIAMS, Waco, Tex. The invention relates to a valve for controlling the passage of cotton from the cotton-bin or warehouse to the elevator by which it is carried to the gins. The valve may be used in connection with an elevator consisting of two divisions, so that one division may be cut out while the other is in operation.

COMBINATION REAMER, TAP, AND COUNTERSINK.—CARL BOENTGEN, Astoria, Ore. Mr. Boentgen has devised an improvement in tools for boring and reaming bung-holes in casks and threading the edges of the holes to adapt them for the reception of screw-threaded bushings having a lateral peripheral flange. The invention is embodied in two separable parts or tools which are constructed to be used separately and also co-operatively, so that one serves as a pivot-post or guide for the other during the formation of the countersink.

ATTACHMENT FOR FIREARM-BARRELS.—READE M. WASHINGTON and ALFRED W. CAPY, Dallas, Tex. The attachment is designed to modify or prevent the noise made when a weapon is discharged and to suppress the smoke almost entirely when black powder is used. The mechanism employed includes a deflecting-plate, a discharge-chamber with a discharge-opening, and a spring-controlled valve. When the bullet is discharged, the gases are deflected downwardly by the deflecting-plate, against the valve. The pressure of these gases forces the valve against the discharge-opening, so that the smoke is imprisoned until the pressure in the barrel is sufficiently reduced to permit the spring to open the valve.

SYRINGE.—CHARLES A. BUCKLIN, Manhattan, New York city. At the upper end portion of the syringe-barrel a hollow, enlarged, and longitudinally-tapered container is formed. The barrel is extended beyond the end of the container. A cup-shaped gland for the syringe-piston stem is adapted to engage with the barrel. A flange on the gland serves as a cover for the container, the flange and gland being integral.

BOOT-HEEL.—CHARLES E. KELLER, Los Angeles, Cal. The inventor has devised a yielding heel for boots and shoes, which heel comprises a rubber-pad to which a spring is attached. The heel is thereby rendered more durable than if constructed entirely of rubber, and yet provides an effective cushion.

GOLD-SEPARATOR. — FRANK P. HOPKINS and LOUIS MANZKE, Spirit Lake, Iowa. Two rotary cylinders are inclined in opposite directions, one arranged above the other. The upper cylinders have two cylindrical screens of different mesh, and a gravel-screen. A chute feeds the pay-dirt from the upper cylinder to the interior screen of the lower cylinder. The coarse material from the upper cylinder is discharged into a rotary pipe and is then passed into a series of receptacles. An air-blast separates fine sand from the values passing into receptacles.

SURGEONS' CASE.—EMIL A. EDLEN, Moline, Ill. The purpose of the invention is to provide a case for carrying surgical instruments. Special attention has been paid to the provision of means for transporting the instruments safely and for permitting their convenient sterilization, as well as the sterilization of other material, such as gauze, bandages, and the like.

HOSE-COUPLING. — SHELDON JOSEPH, Columbus, and WILLIAM H. CLARK and WILLIAM J. CLARK, Salem, Ohio. The coupling is designed to be used where the internal pressure is less than the external pressure. One section of the coupling has within its head a metallic tubular extension separated from the contiguous surface of the head by an annular chamber. The other mating section of the coupling is provided with a flexible tube adapted to enter the chamber of the first-named section between the wall of the head and the tubular extension.

INCUBATOR.—JOHN MABUS, Minier, Ill. The purpose of the invention is to furnish a means for turning eggs in an incubator without opening the cover. The incubator has a member movable longitudinally to turn the eggs and movable transversely to be passed in and out of the incubator. Combined with this apparatus is a reciprocating-bar to which fingers are attached, which engage lugs or projections on the members of the incubator.

HAT-SIZE INDICATOR.—ABRAM B. LUSTIG, Manhattan, New York city. The indicator has separable sections, each of which corresponds with one of the hats in a box. If a hat be removed from the box, the corresponding section of the indicator may be detached, the remaining portion of the indicator thus showing not only that one hat has been taken out, but also what sizes are still left.

SAW.—RALPH ROCKWELL, Oracle, Arizona Territory. The top and front portion of this buck-saw are made of a single length of material having a channel along its top or outer portion. A back or handle portion extends above the top of the frame. To this upward extended portion a tie-rod is attached, which is carried through the slot of the front and then through an opening in the front near its lower end. A frame thus made is light and strong. The usual lateral vibrations are obviated, since the frame consists of but two sections connected by the handle.

LIFE-PRESERVER.—PASQUALE ANGELLILI, 27 Mulberry Street, Manhattan, New York city. The life-preserver consists essentially of two parts, a carbid receptacle and a water compartment, communication between the two being cut off by a spring-pressed valve held in a normal, closed position by some filling soluble in water. When the preserver is in use, sea-water dissolves the filling, thereby removing the resistance to the valve-spring and opening the passage between the carbid and water receptacles. The acetylene gas generated serves to inflate the life-preserver. The parts can be separated whenever they are to be cleaned.

### Designs.

BOOK-HOLDER.—EDWIN S. WOEHR, Geneseo, Ill. The base of the holder is a parallelogram with laterally and vertically extending supports for the books.

GAME-BOARD.—JAMES L. ROBERTSON, JR., Manhattan, New York city. The design provides a miniature football game-board furnished with figures upon which the various plays are indicated, such as goal from the field, end play, tackle play, center play, kick off, answer to kick off, goal play, return kick, and answer to kick.

NOTE.—Copies of any of these patents can be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

## NEW BOOKS, ETC.

MUNICIPAL IMPROVEMENTS. A Manual of Methods, Utility and Cost of Public Improvements for the Municipal Officer. By W. F. Goodhew, C.E. Third Edition. Illustrated. New York: John Wiley & Sons. 1900. 12mo. Pp. 207. Price $1.75.

The aim of the writer of this work has been to assist members of municipal councils, etc., in obtaining a good perspective view of the general plan and scope of various public improvements contemplated during their administration. The trend of the education of all such persons has usually been along other lines, but there is no reason why they should not have an intelligent grasp of the broad facts relating to the municipality, so as to enable them to pass intelligently upon the various measures proposed and enable them even to initiate such measures.

PRACTICAL HINTS ON JOINT WIPING FOR BEGINNERS IN PLUMBING. New York: David Williams Company. 1900. 16mo. Pp. 66. Price 25 cents.

A practical series of articles have been combined and published in pamphlet form, and the book will prove useful to all plumbers and also to those who have occasion to do joint wiping on copper pipes, and on brass, iron, and tin pipes.

MEXICAN CUSTOM HOUSE TARIFF. English Translation from the Official Edition. Translated and revised by J. P. Taylor. City of Mexico: F. P. Hoeck & Co. 1900. 12mo. Pp. 180. Price $2.50 United States currency.

A very useful book for all who have business with Mexico.

A HUNDRED YEARS OF GERMAN BRIDGE BUILDING. By George C. Mehrtens. Berlin: Julius Springer. 1900. Folio. Pp. 135.

This book was published for the Paris Exposition of 1900, by a number of German firms of bridge builders, and the edition is intended for the use of engineers who visit the Exposition. The subject is admirably treated, the illustrations are good and there are 195 half-tone and line engravings. A vast amount of information is given in the large volume. It is a very satisfactory contribution to engineering literature, and reflects great credit upon the firms concerned in its production.

ACETYLENE. A Hand Book for the Student and Manager. By Vivian B. Lewes, F.I.C. London: Archibald Constable & Company. New York: The Macmillan Company. 1900. 8vo. Pp. 978. Price $7.

The author is a well known gas engineer who has contributed a large number of papers of great merit to the scientific press. The book which he has produced is one of the most excellent technical works which it has ever been our pleasure to review. The author's style is lucid and his treatment of the subject is most thorough and shows an intimate acquaintance with every detail of the subject. The publisher has done his part by printing the book beautifully, and the contents of the paragraphs are briefly noted in red ink marginal notes, adding a great deal to the value of the book. The half-tone engravings are excellent and well printed; in all there are 228 engravings. The book is divided into three parts—scientific, technical and a digest of legal enactments and English patents. One of the most interesting illustrations is a lamp post for an independent generator. In country districts this will undoubtedly prove of great value.

HOW TO MAKE AND HOW TO MEND. By an Amateur Mechanic. London: Swan Sonnenschein & Company, Limited. New York: The Macmillan Company. 1900. 16mo. Pp. 288. Price $1.25.

The book has no Preface and the arrangement is entirely alphabetical. It tells how to make a number of simple articles such as electric bells, toy balloons, boats, how to do bookbinding, how to make paint brushes, butterfly cabinets, how to clean carpets, plaster casts, how to draw curves, how to do dyeing, egg blowing, to tie knots and many other subjects of the same general kind. The material is most heterogeneous, but the book will probably prove of value to amateurs who wish to do little odd jobs around the house.

PREHISTORIC IMPLEMENTS. A Reference Book. By Warren K. Moorehead, assisted by others. Cincinnati, Ohio: Robert Clark & Company. 8vo. Pp. 429, 621 figures. Price $3.

The author antagonizes the reader at once by stating that there are twenty-seven men who may be considered as scientific archæologists, and that there are twenty-three others connected with museums, in various capacities, and it is from the reports and other publications of these twenty-seven authors that much of the information printed in this book has been obtained. The book is very well illustrated and the engravings show 3,000 specimens. The author states that 5,450 persons in the United States and Canada are more or less interested in the study of prehistoric archæology, Mr. Moorehead having kept a card index of such persons. To them the book will undoubtedly be of considerable interest, and it will tend to inform the student and beginner, and stimulate the study of implements in museums and private collections.

HYDRAULIC POWER ENGINEERING. By G. Croydon Marks. New York: D. Van Nostrand Company. London: Crosby Lockwood & Son. 1900. Pp. 360, 200 illustrations. Price $3.50.

This work may be regarded as a successor to a smaller volume of the same author on "Hydraulic Machinery." In the present book an attempt is made to give an outline discussion and description of the main points and principles requiring attention by engineers having the responsibility of designing or constructing works and appliances for the utilization of water for the transmission of power. It is an elaborate treatise and is well illustrated. The author understands the subject thoroughly and is able to present recent practice.

TABLES OF PLATE AND RIVET VALUES, FOR THE USE OF BOILER DESIGNERS, BOILER MAKERS, ETC. By Thomas H. Craft, Cleveland, Ohio. Three-fold table.

ENGINE TESTS. By George H. Barrus, S. B. New York: D Van Nostrand Company. 1900. 8vo. Pp. 339. Price $4.

The volume embraces the results of over a hundred feed water tests and other investigations of steam engines, conducted by the author. It is believed that the data here presented will prove of value to the engineering profession and to owners and intending purchasers of steam plants and to any who are interested in the economical production of power. The tests are fully described and the data presented is elaborate. The book is a solid contribution to the literature of steam engineering.

## Business and Personal.

Marine Iron Works. Chicago. Catalogue free.

For logging engines. J. S. Mundy, Newark, N. J.

"U. S." Metal Polish. Indianapolis. Samples free.

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The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

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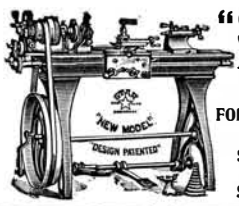

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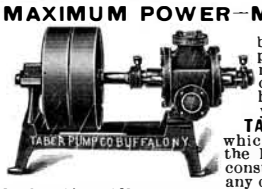


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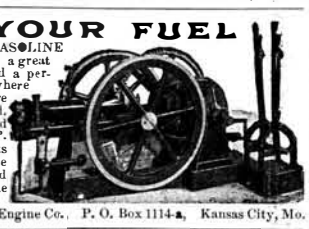

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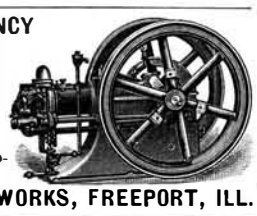

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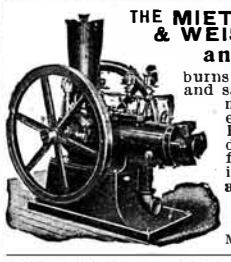

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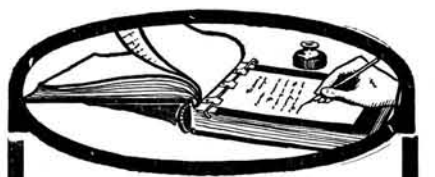

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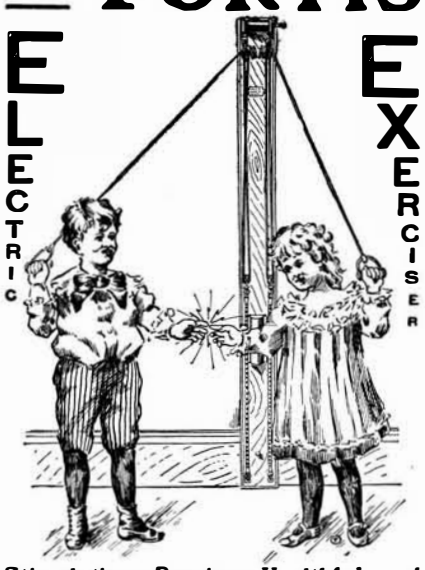

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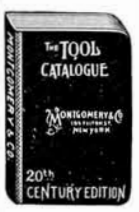


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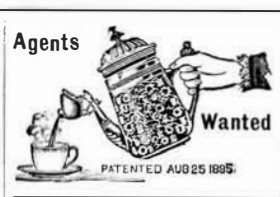


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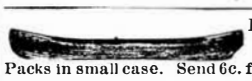

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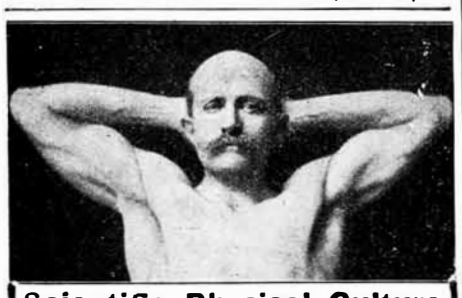

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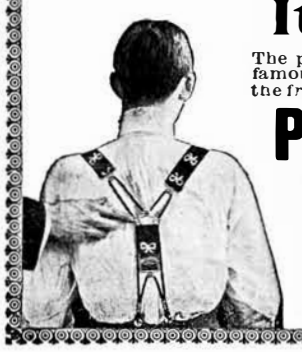

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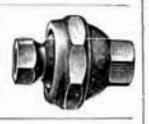

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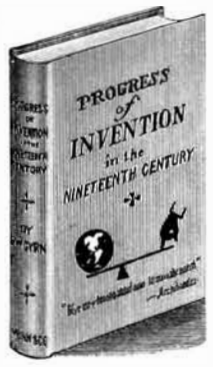


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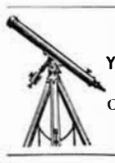

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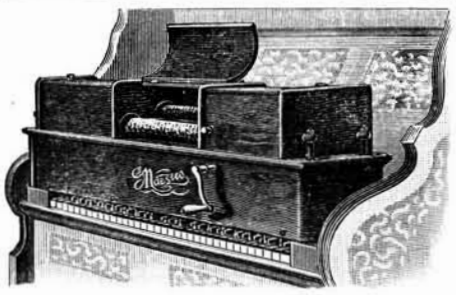

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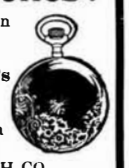

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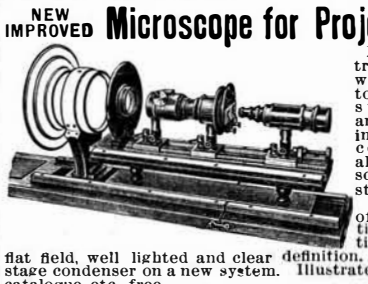

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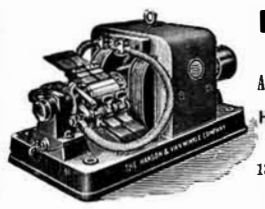

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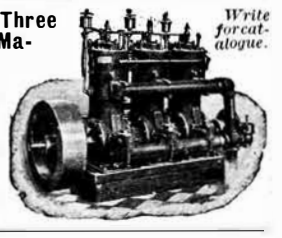

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